Monitoring Report MY07/Closeout

Sandy Bridge Restoration Site
DMS Contract 6400
DMS Project Number 96920

DWR #: 15-0414
USACE Action ID: 201500827
Rutherford County, North Carolina

Prepared for:
NCDMS, 1652 Mail Service Center, Raleigh, NC 27699-1652

Monitoring Data Collected: 2023
Date Submitted: December 2023

Monitoring and Design Firm

Prepared by:

KCI Associates of North Carolina, PA
4505 Falls of Neuse Road
Suite 400
Raleigh, NC 27609
(919) 783-9214

Project Contact: Adam Spiller
Email: adam.spiller@kci.com

KCI ASSOCIATES OF NORTH CAROLINA, PA

ENGINEERS • SCIENTISTS • SURVEYORS • CONSTRUCTION MANAGERS

4505 Falls of Neuse Road Suite 400 Raleigh, NC 27609 (919) 783-9214 (919) 783-9266 Fax

January 24, 2024

Mr. Harry Tsomides
North Carolina Division of Mitigation Services
5 Ravenscroft Dr. #102
Asheville, NC 28801

Re: Response to Sandy Bridge Farm MY07 Report Comments

Dear Mr. Tsomides,

KCI has reviewed the comments prepared by the DMS for the Sandy Bridge Farm MY07 Report and has prepared the following responses:

- Asset Table –Thank you for providing a wetland asset estimated deduction, and mapping it on the CCPV; however project assets and asset tables cannot formally change without an approved mitigation plan addendum, or a decision at IRT close out (2024). Please revert the assets in the asset table to 1,626.000 Stream and 6.653 wetland; the wetland deduction mapping and description in this report (0.385 acres) should remain, and will be discussed at close out in 2024 (and final assets revised as appropriate following close out).
  KCI Response: The asset table has been reverted back to the original table.

- Please add a brief discussion/section indicating that this project is being proposed for close out with the IRT in 2024, and summary statement that KCI feels the project has achieved all success criteria and is ready for close out. Please mention in this section that KCI met with DMS and DEQ Stewardship on site with the landowner on 8/11/2023, and that all action items have been completed and the project has been approved by the DEQ Stewardship Program for transfer.
  KCI Response: This has been added to the report.

- Please change the title of the report to "Monitoring Report MY07 / Close Out" or similar.
  KCI Response: This change has been made.

- Please include the 5/26/2023 IRT correspondence letter in an Appendix at the end of the report.
  KCI Response: This letter has been added to the report.

- Please provide a georeferenced CCPV as part of the report, or in the digital support files. None of the PDF CCPVs included in the report or the support files are georeferenced.
  KCI Response: Georeferenced versions of the CCPV have been added to the digital files.

- Thank you for the 3 soil profiles conducted at/around GW2, GW10 and GW11, and symbols shown on the map; it would be helpful to show a) the soil profile photos associated with these borings, if available, and b) soil boring labels (IDs) on the CCPV. *KCI Response: Photos of the soil borings are not available but labels have been added to the CCPV.*

Please contact me if you have any questions or would like clarification concerning these responses.

Sincerely,

Adam Spiller
Project Manager

TABLE OF CONTENTS

Appendix A – Background Tables

Appendix B – Visual Assessment Data

Appendix C – Vegetation Data

Appendix D – Stream Measurement and Geomorphology Data

Appendix E – Hydrologic Data

Appendix F – Additional Data

PROJECT SUMMARY

The Sandy Bridge Farm Restoration Site (SBFRS) was completed in March 2017 and restored a total of 6.85 acres of riparian wetland (1.29 acres of wetland rehabilitation and 5.56 acres of wetland reestablishment) and 1,626 linear feet of stream. The SBFRS is a riparian system located in the Broad River Basin (03050105 8-digit cataloging unit) in Rutherford County, North Carolina that had been substantially modified to maximize the use of the area for grazing. The completed project will restore impacted agricultural lands to a functioning stream and wetland ecosystem with enhanced water quality, restored hydrology, and improved fish and wildlife habitat.

The SBFRS is protected by a 9.5 acre permanent conservation easement, held by the State of North Carolina. The site is located off of Rock Road, approximately 3 miles north of Rutherfordton, North Carolina. The project site is bounded by interspersed pastureland and forested land to the east, agricultural land and Rock Road to the north-northwest, and Catheys Creek to the southwest.

The North Carolina Ecosystem Enhancement Program's (NCEEP) publication in 2009 identified HUC 03050105070020 (Catheys Creek) as a Targeted Local Watershed (TLW). The goals and priorities for SBRFS are based on the information presented in the Broad River Basin Restoration Priorities: to restore wetland and stream functions, to maintain and enhance water quality, to restore hydrology, and to improve fish and wildlife habitat (NCEEP 2009). The project goals, which reflect those from the approved Mitigation Plan, are in line with the following basin priorities:

- Reduce sources of sediment and nutrients by restoring riparian buffer vegetation, excluding livestock, and restoring natural geomorphology.
- Prioritize project implementation in the Catheys Creek local watershed planning area.

The goals for the project are to:

- Restore a channelized stream to a meandering C-type channel with a floodplain.
- Buffer and reduce sediment impacts to the project stream.
- Restore a Piedmont Alluvial Forest Community.
- Restore a wetland hydroperiod to drained and livestock-impacted land.

The project goals will be addressed through the following objectives:

- Relocate a channelized stream to its historic landscape position.
- Install an appropriately-sized channel cross-section.
- Install bedform diversity with pools, riffles, and habitat structures.
- Demarcate the project easement boundaries and fence out livestock.
- Plant the site with native trees and shrubs and an herbaceous seed mix that supports the development of a Piedmont Alluvial Forest.
- Fill field ditches and redevelop wetland microtopography to slow the flow of surface and subsurface drainage.

To restore the site, select ditches across the site were modified or filled and incoming surface inputs and seeps were integrated to create a stream/wetland complex. Additionally, Tributary 1 to Catheys Creek was improved with Priority 1 stream restoration to re-meander the stream and elevate the groundwater table. The entire site was planted as a Piedmont Alluvial Forest community (Schafale 2012). The site was constructed as designed with no modification from the design plan.

The majority of monitoring components were installed in March 2017. Nine groundwater monitoring wells were installed to evaluate the attainment of jurisdictional wetland hydrology. A stream gauge was installed on Tributary 1 to Catheys Creek to record the occurrence of bankfull events. To determine the success of the planted mitigation areas, eight 10 m x 10 m permanent vegetation monitoring plots were established. The location of the planted stems relative to the origin within these plots, as well as the species, was recorded and planted stems were grouped into size categories (0-10 cm, 10-50 cm, 50-100 cm, >137 cm). Any volunteers found within the plots were also grouped into size categories by species, but separate from the planted stems. Six permanent photo reference points were established and will be taken annually. Four permanent cross-sections (two sets of coupled riffles and pools) were also established and a detailed longitudinal profile of the stream was taken. The cross-section measurements will be repeated in future monitoring years, but the longitudinal profile will only be repeated if there are concerns about bed elevation adjustments. Reports will be submitted to DMS by the end of each monitoring year. During a site visit with the IRT on December 6, 2017, it was requested that KCI install three additional groundwater monitoring wells and two additional vegetation plots. On March 30, 2018 the three additional groundwater monitoring wells were installed along the area of the filled, pre-construction stream channel. On September 10, 2018, the two additional vegetation plots were installed near the southern end of the site.

The right bank of the stream flowing adjacent to the project's southern boundary had been experiencing significant erosion due to several areas of obstruction in the center of this channel that were diverting water into the banks. Although this stream is not part of the project, and is located outside of the easement bounds, the erosion on the right bank had encroached into the easement. In November 2019, KCI repaired and stabilized this area. This work involved removing the mid-channel obstructions and sloping back the eroding bank. 150 live stakes were planted along this bank in March 2020. During this work, several farm gates that had become buried in the project stream bank were removed and a small swale was dug to direct water into the site from fields adjacent to the eastern boundary of the site. This swale was designed to drain ponded conditions in these fields and dissipate the water throughout the wetlands on-site.

Vegetative success criteria for the site is 320 woody stems/acre after three years, 260 woody stems/acre after five years, and 210 woody stems/acre after seven years. The baseline monitoring counted an average of 647 woody stems/acre. To meet the hydrologic success criteria, the upper 12 inches of the soil profile must have continuously saturated or inundated conditions for at least 10% of the growing season during normal weather conditions. The soil survey for Rutherford County estimates the growing season begins April 4 and ends November 6 (217 days), meaning the water table must be within 12 inches of the surface for at least 22 consecutive days during the growing season. A minimum of two bankfull events must also be recorded during the monitoring period. Bank height ratios should not exceed 1.2 and the entrenchment ratios should be 2.2 or greater. Visual assessments will also be used to identify problem areas.

MONITORING RESULTS

The site was planted in March 2017 with tree tube protection installed around many of the planted stems. Over the years, beaver have been present at the site and have impacted site vegetation. Although there is still a good quantity of woody stems, beaver activity has taken out some stems that had grown larger. Even with the beaver impacts, in general the site is well vegetated, with widespread herbaceous coverage and many healthy planted stems. A supplemental planting of the site occurred in March 2020. 524 one-gallon size trees were planted in the wetland rehabilitation area and 1,875 bare root trees were planted in the central portion of the site and around the stream. The planting in the wetland rehabilitation area was done as a means of addressing a small area of low growth and vigor caused by dense herbaceous vegetation. The planting in the central

portion of the site was done to mitigate damage done by the beavers. An additional supplemental planting of approximately 300 live stakes was completed in April 2022. This planting consisted of live stakes cut from black willow, elderberry, silky dogwood, sycamore, and cottonwood trees on site in approximately equal quantities of each. This planting focused on the areas most heavily impacted by the beavers and covered an area of approximately 2.5 acres (120 stems/acre). During MY06, the IRT requested that KCI sample vegetation transects through the beaver impacted areas to ensure that the vegetation on site was meeting the performance standards. Four 100-foot long transects were sampled, and a total of 47 stems and 15 species were recorded, along with an average height of 24 feet.

The seventh-year vegetation monitoring was conducted on July 11, 2023. The site averaged 433 planted stems/acre across all 10 plots. Nine of the 10 plots had greater than 210 planted stems/acre, with only Plot 6 (162 stems/acre) not achieving the success criteria. This plot is in the area most heavily impacted by beaver and represents an isolated area. Many large, healthy stems are present just outside of this plot. Including volunteers, the site averaged 550 total stems/acre.

Daily rainfall data were obtained from the NC State Climate Office for a local weather station in Rutherfordton, NC. In 2023 the month of January, April, and September experienced average rainfall. The months of February, March, May, June, July, October, and November experienced below average rainfall for the site. No months experienced above average rainfall in 2023. Overall, the area experienced well below average rainfall during the 2023 growing season. During the site's seventh growing season, 6 of the 12 groundwater monitoring wells had continuous saturation within 12 inches of the ground surface for 10% (22 days) or more of the 217 day growing season (April 4 to November 6). The lower than usual level of success that the gauges achieved in 2023 is due to the very low amount of rainfall that the site experienced this year.

Gauge 10 has only achieved the success criteria in one of the six years that it has been installed and so, during the seventh growing season, KCI delineated an area around this gauge that has been designated as a "low performing area." This delineation was based on the vegetation, soils, and local relief of the area surrounding Gauge 10. An area of 0.385 acres was identified and has been removed from credit calculations for the site. This area was entirely within the wetland reestablishment area on the site and the asset table has been updated to reflect this change. Please see Appendix F – Additional Data for detailed soil profile descriptions taken in and around this area.

The stream gauge has recorded multiple bankfull events in each year since construction, including 3 bankfull events in 2023. In June 2018, several large beaver dams were discovered towards the lower half of the stream. These dams were removed in early August 2018 and since then KCI has been continuously monitoring for further signs of beaver activity, trapping beavers on-site and removing dams when they are found. Additional dams were removed in November 2018, June 2019, August 2019, October 2019, June 2020, September 2020, December 2020, November 2021, January 2023, and March 2023. As of the end of year site walk on November 14, 2023, no new dams had been built since those that were removed in March 2023.

Due to the history of beaver dams on-site, there has been more aggradation in the stream channel than has been anticipated. KCI has been removing the beavers and dams routinely, but when the dams are built sediment has deposited in the channel. The seventh-year cross-section survey showed bed aggradation in all four cross-sections as well as aggradation on the banks of Cross-sections 1 and 2, when compared to the baseline conditions. Compared to the Year 4 and 5 cross-section survey, however, these cross-sections have remained stable since the initial period of

aggradation during Monitoring Years 1-3. Streamflow has also remained within the restored channel, and no evidence of other channels forming or other forms of floodplain instability have been noted. The stream is continuing to function as a stream, despite the heavy beaver presence over the years. KCI does not view this deviation from the baseline conditions as a problem for the project, but rather just the evolution of the system within the natural environment.

The monitored cross-section data have been calculated by adjusting the bankfull elevation to maintain the baseline bankfull area for each cross-section. A total cross-sectional metric has been added to the cross-section data to indicate the cross-sectional area below the baseline bankfull elevation. In instances where there has been some lateral aggradation and narrowing, the data show the cross-section having a significantly higher bankfull width and higher width/depth ratio as compared to previous years. The comparison of cross-section plots between monitoring events illustrates that these adjustments do not indicate a problematic change in cross-section condition but are part of the processing of sediment through the site as described above.

The site is being proposed for closeout in 2024. The stream has remained stable throughout the course of monitoring, despite the heavy beaver presence, and has experienced multiple bankfull events in each monitoring year. The vegetation on the site has also developed into a diverse and healthy community, with all but one of the vegetation monitoring plots achieving the success criteria. Many large woody stems are present throughout the site, as well as a robust herbaceous layer. The site has demonstrated successful hydrology across the majority of the site throughout the seven years of monitoring. All but one of the gauges (Gauge 10) achieved the success criteria in at least 50% of the growing seasons that they were installed, with 6 of the twelve gauges achieving it in every year. Overall, the site has demonstrated consistent wetland hydrology throughout the monitoring period. KCI met with the landowner, DMS, and DEQ Stewardship on site on 8/11/2023. All action items from this meeting have been completed and the project has been approved by the DEQ Stewardship Program for transfer. Based on all of these facts, KCI believes that the site has demonstrated that it has developed into a healthy and functioning stream and wetland ecosystem and is ready for closeout.

REFERENCES

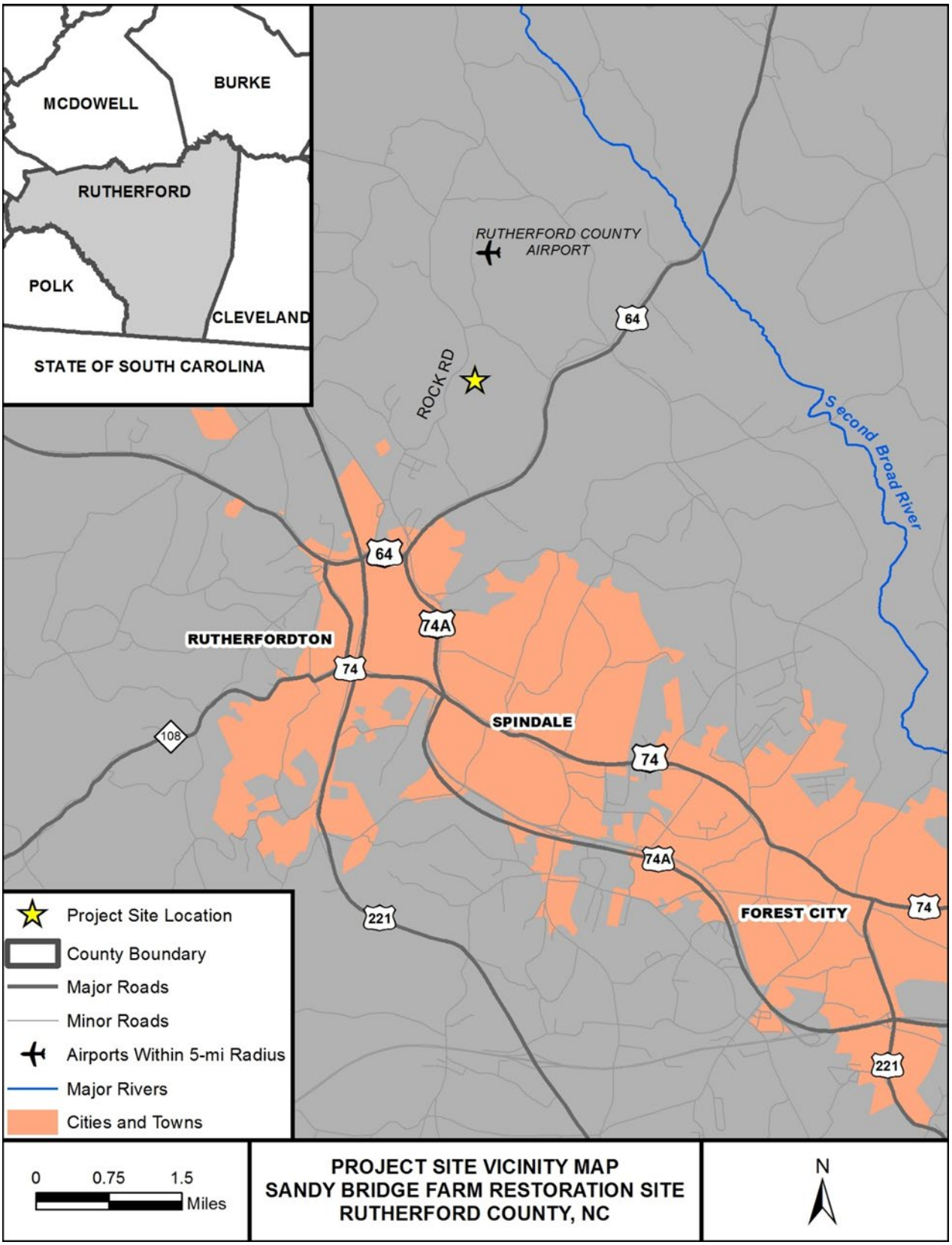
NCDENR, Ecosystem Enhancement Program. 2009. Broad River Basin Restoration Priorities 2009. Raleigh, NC. Last accessed 1/2016 at: http://portal.ncdenr.org/c/document_library/get_file?uuid=705d1b58-cb91-451e-aa58-4ef128b1e5ab&groupId=60329

NCDENR, Ecosystem Enhancement Program. 2014. NCDENR, Ecosystem Enhancement Program. 2014. Stream and Wetland Mitigation Monitoring Guidelines. Last accessed1/2016 at: http://portal.ncdenr.org/c/document_library/get_file?p_l_id=60409&folderId=18877169&name=DLFE-86604.pdf

NCDENR, Ecosystem Enhancement Program. 2014. Stream and Wetland Mitigation Monitoring
Guidelines. Last accessed 6/2015 at: http://portal.ncdenr.org/c/document_library/get_file?p_l_id=60409&folderId=18877169&name=DLFE-86606.pdf

NC Wetland Functional Assessment Team. 2010. NC Wetland Assessment Method (NC WAM)
User Manual, version 4.1. Last accessed 11/2012 at: http://portal.ncdenr.org/c/document_library/get_file?uuid=76f3c58b-dab8-4960-ba43-45b7faf06f4c&groupId=38364

Schafale, M.P. and A.S. Weakley. 2012. Guide to the Natural Communities of North Carolina:
Fourth Approximation. Natural Heritage Program, Division of Parks and Recreation, N.C. Department of Environment and Natural Resources. Raleigh, NC.


MCDOWELL
BURKE
RUTHERFORD
POLK
CLEVELAND
STATE OF SOUTH CAROLINA
RUTHERFORD COUNTY AIRPORT
ROCK RD
64
Second Broad River
64
74A
RUTHERFORDTON
74
SPINDALE
108
74
74A
221
FOREST CITY
74
221
Project Site Location
County Boundary
Major Roads
Minor Roads
Airports Within 5-mi Radius
Major Rivers
Cities and Towns
0
0.75
1.5
Miles
PROJECT SITE VICINITY MAP
SANDY BRIDGE FARM RESTORATION SITE
RUTHERFORD COUNTY, NC
N

APPENDIX A

Background Tables

Table 1. Project Components and Mitigation Credits
Sandy Bridge Farm Restoration Site, DMS Project #96920

Mitigation Credits

	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Credits	1,626		6.653						

Project Components

Project Component -or- Reach ID	Stationing/ Location	Existing Footage/ Acreage	Approach (PI, PII etc.)	Restoration -or- Restoration Equivalent	Restoration Footage/ Acreage	Mitigation Ratio	Credits
Tributary 1	10+00 to 26+26	1,470 lf	PI	Restoration	1,626 lf	1:1	1,626
Wetland Reestablishment				Restoration	5.560 ac	1:1	5.560
Wetland Rehabilitation*		0.79 ac		Restoration	0.697 ac	1:1	0.697
Wetland Rehabilitation		0.59 ac		Restoration	0.594 ac	1.5:1	0.396

Component Summation

Restoration Level	Stream (linear feet)	Riparian Wetlands (Acres)		Non-Riparian Wetlands (Acres)	Buffer (square feet)	Upland (Acres)
		Riverine	Non-Riverine			
Restoration	1,626 lf					
Reestablishment		5.560 ac				
Rehabilitation		1.291 ac				
Enhancement						
Creation						
Preservation						
High Quality Preservation						

R= Restoration RE= Restoration Equivalent of Creation or Enhancement
*=wetland rehabilitation associated with filled ditches

Table 2. Project Activity & Reporting History Sandy Bridge Farm Restoration Sites, DMS Project #96920		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Mitigation Plan		June 2016
Final Design - Construction Plans		June 2016
Construction Grading Completed		Aug 29, 2016
Planting Completed		March 11, 2017
Baseline Monitoring/Report	March 2017	April 2017
Vegetation Monitoring	*March 21, 2017*	
Stream Survey	*March 20, 2017*	
Year 1 Monitoring	November 2017	December 2017
Vegetation Monitoring	*October 26, 2017*	
Stream Survey	*November 6, 2017*	
Additional Groundwater Gauges Installed		March 30, 2018
Beaver Dam Removal		August 20, 2018
Additional Vegetation Plots Installed		September 10, 2018
Beaver Dam Removal		November 6, 2018
Year 2 Monitoring	November 2018	December 2018
Vegetation Monitoring	*September 10, 2018*	
Stream Survey	*XS1 and 2: June 28, 2018* *XS3 and 4: September 11, 2018*	
Beaver Dam Removal		June 14, 2019
Beaver Dam Removal		August 8, 2019
Beaver Dam Removal		October 17, 2019
Non-project Reach Repair		November 21, 2019
Year 3 Monitoring	November 2019	December 2019
Vegetation Monitoring	*July 11, 2019*	
Stream Survey	*June 19, 2019*	
Supplemental Planting		March 27, 2020
Beaver Dam Removal		June 12, 2020
Beaver Dam Removal		September 15, 2020
Beaver Dam Removal		December 18, 2020
Year 4 Monitoring	November 2020	December 2020
Stream Survey	*November 4, 2020*	
Beaver Dam Removal		November 17, 2021
Year 5 Monitoring	November 2021	December 2021
Vegetation Monitoring	*July 6, 2021*	
Stream Survey	*July 6, 2022*	
Supplemental Live Stake Planting		April 12, 2022
Year 6 Monitoring	November 2022	December 2022
Vegetation Transects	*October 17, 2022*	
Beaver Dam Removal		January 3, 2023
Beaver Dam Removal		March 1, 2023
Year 7 Monitoring	November 2023	December 2023
Vegetation Monitoring	*July 11, 2023*	
Stream Survey	*September 7, 2023*	

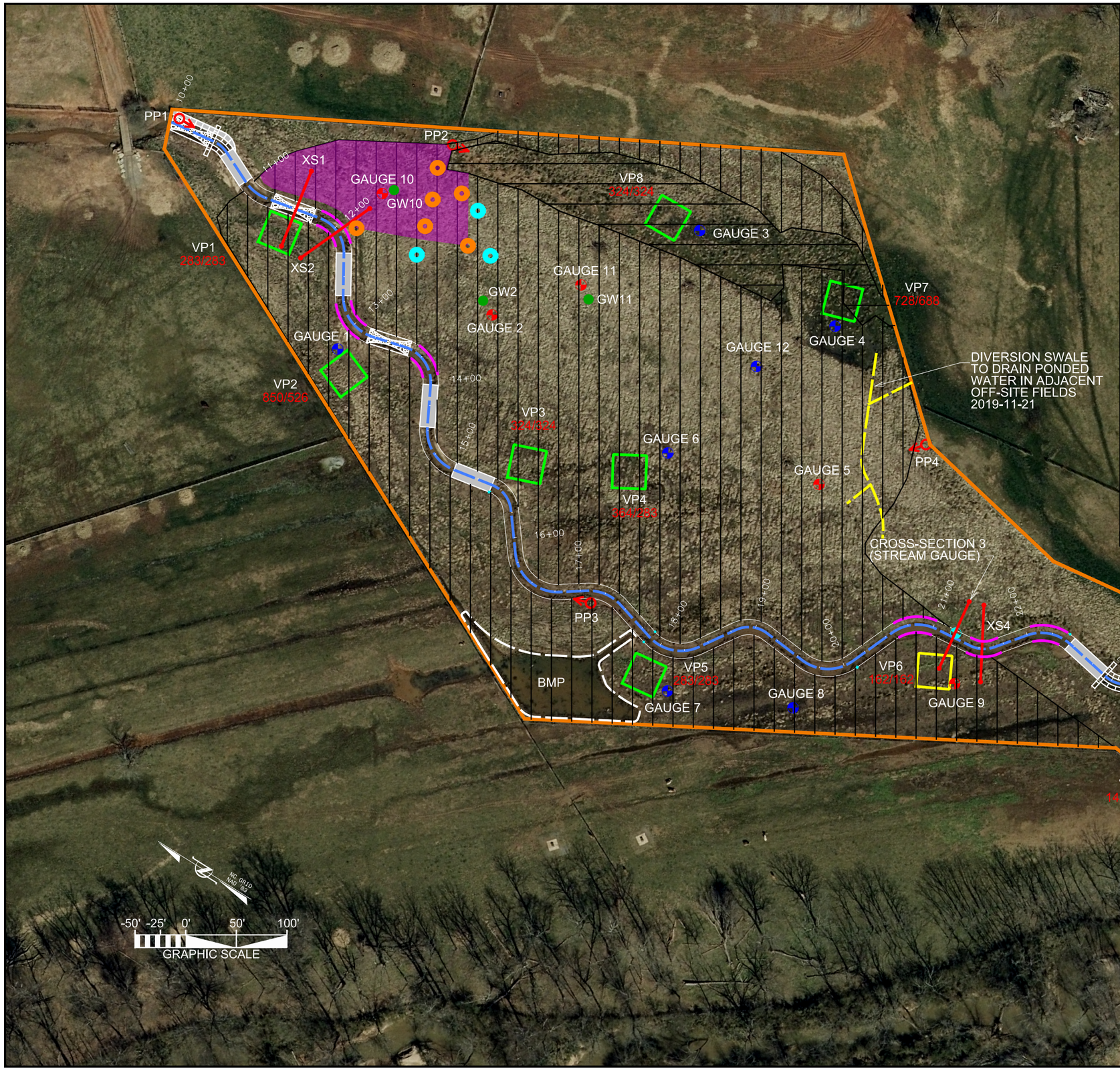
Table 3. Project Contacts Sandy Bridge Farm Restoration Sites, DMS Project #96920	
Design Firm	KCI Associates of North Carolina, PA 4505 Falls of Neuse Road Suite 400 Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 783-9214 Fax: (919) 783-9266
Construction Contractor	KCI Environmental Technologies and Construction 4505 Falls of Neuse Road, Suite 400 Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 783-9214
Planting Contractor	Conservation Services Inc. 1620 N. Delphine Ave. Waynesboro, VA 22980 Contact: Mr. David Coleman Phone: (540) 941-0067
Monitoring Performers	KCI Associates of North Carolina, PA 4505 Falls of Neuse Road Suite 400 Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 278-2514 Fax: (919) 783-9266

Table 4. Project Information Sandy Bridge Farm Restoration Site, DMS Project #96920			
Project Name	Sandy Bridge Farm Restoration Site		
County	Rutherford County		
Project Area (acres)	9.45 acres		
Project Coordinates (lat. and long.)	35.407997° N, -81.937000° W		
Project Watershed Summary Information			
Physiographic Province	Piedmont		
River Basin	Broad		
USGS Hydrologic Unit 8-digit	03050105	**USGS Hydrologic Unit 14-digit**	03050105070020
DWQ Sub-basin	9-41-13-(0.5)		
Project Drainage Area (acres)	837 acres		
Project Drainage Area Percentage of Impervious Area	8%		
CGIA Land Use Classification	Mixed Hardwoods/Conifers 42% (350.0 ac), Managed Herbaceous Cover 39% (329.3 ac), Mountain Conifers 12% (99.5 ac), Mixed Shrubland 5% (43.5 ac), Low Intensity Developed 1% (11.0 ac)		
Existing Reach Summary Information			
Parameters	**T1**		
Length of reach (linear feet)	1,470 lf		
Valley classification	Valley Type VIII		
Drainage area (acres)	837 acres		
NCDWQ Water Quality Classification	WS-V (Water Supply – upstream)		
Morphological Description (stream type)	Ditched channel		
Evolutionary trend	Channelized		
Mapped Soil Series	Wehadkee-Chewacla Association		
Drainage class	Poorly drained; Somewhat poorly drained		
Soil Hydric status	Drained hydric		
Slope	0-1%		
FEMA classification	Zone AE		
Existing vegetation community	N/A (Pasture)		
Percent composition of exotic invasive vegetation	5%		
Existing Wetland Summary Information			
Parameters			
Size of Wetland (acres)	0.59 acres (Wetland Rehabilitation Area)		
Wetland Type	Headwater Seep		
Mapped Soil Series	Wehadkee-Chewacla Association		
Drainage class	Poorly drained; Somewhat poorly drained		
Soil Hydric Status	Drained Hydric		
Source of Hydrology	Seepage/ Precipitation		
Hydrologic Impairment	Ditching and Grazing		
Existing vegetation community	Emergent Wetland		
Percent composition of exotic invasive vegetation	5%		

Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States – Section 404	Yes	DWR# 15-0414 USACE Action ID# 201500827	Jurisdictional Determination
Waters of the United States – Section 401	Yes	DWR# 15-0414 USACE Action ID# 201500827	Jurisdictional Determination
Endangered Species Act	No	N/A	N/A
Historic Preservation Act	No	N/A	N/A
Coastal Zone Management Act (CZMA)/ Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	No	N/A	N/A
Essential Fisheries Habitat	No	N/A	N/A

APPENDIX B

Visual Assessment Data



LEGEND:

- VEG PLOT ACHIEVING DENSITY CRITERION
- VEG PLOT BELOW DENSITY CRITERION
- *VEG PLOT TOTAL / PLANTED STEM DENSITY — 550/433
- WETLAND GAUGE ACHIEVING HYDRO. CRITERION
- WETLAND GAUGE BELOW HYDRO. CRITERION
- PHOTO POINT
- CROSS-SECTION
- CONSERVATION EASEMENT
- STREAM RESTORATION
- WETLAND REESTABLISHMENT
- WETLAND REHABILITATION
- STEP POOL
- RIFFLE GRADE CONTROL
- RIFFLE ENHANCEMENT
- STREAM AGGRADATION
- LOW PERFORMING HYDROLOGY AREA
- DRY SOIL BORINGS
- WET SOIL BORINGS
- SOIL DESCRIPTIONS

IMAGE SOURCE: GOOGLE EARTH 2019

REVISIONS

STNL	DESCRIPTION	DATE

NCDEQ DIVISION OF MITIGATION SERVICES

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4505 FALLS OF NEUSE RD, SUITE 400
RALEIGH, NORTH CAROLINA 27609

SANDY BRIDGE FARM
STREAM AND RIPARIAN WETLAND SITE

DMS PROJECT #96920
RUTHERFORD COUNTY, NORTH CAROLINA
MONITORING YEAR 07

DATE: NOV 2023
SCALE: GRAPHIC

CURRENT CONDITION PLAN VIEW

Table 5 **Visual Stream Morphology Stability Assessment**
Sandy Bridge Farm Stream Restoration Site, DMS Project#96920
Reach ID **Reach 1**
Assessed Length **1626** Assesment Date: 11/14/2023

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			6	194	88%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	20	20			100%
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	14	20			70%
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	20	20			100%
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	20	20			100%
		2. Thalweg centering at downstream of meander (Glide)	20	20			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
				Totals	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	8	8			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	8	8			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	5	5			100%
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	6	6			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	5	5			100%

Table 6 **Vegetation Condition Assessment**

Sandy Bridge Farm Stream Restoration Site, DMS Project# 96920

Planted Acreage **9.5** Assesment Date: 11/14/2023

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	0	0.00	0.0%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
			Cumulative Total	0	0.00	0.0%
Easement Acreage	**9.5**					
Vegetation Category	**Definitions**	**Mapping Threshold**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Easement Acreage**
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1000 SF	Pattern and Color	0	0.00	0.0%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	none	Pattern and Color	0	0.00	0.0%

Photo Reference Photos

PP1 – MY-00 – 3/21/17

PP1 – MY-07 – 11/14/23

PP2 – MY-00 – 3/21/17

PP2 – MY-07 – 11/14/23

PP3 – MY-00 – 3/21/17

PP3 – MY-07 – 11/14/23

PP4 – MY-00 – 3/21/17

PP4 – MY-07 – 11/14/23

PP5– MY-00 – 3/21/17

PP5– MY-07 – 11/14/23

PP6– MY-00 – 3/21/17

PP6– MY-07 – 11/14/23

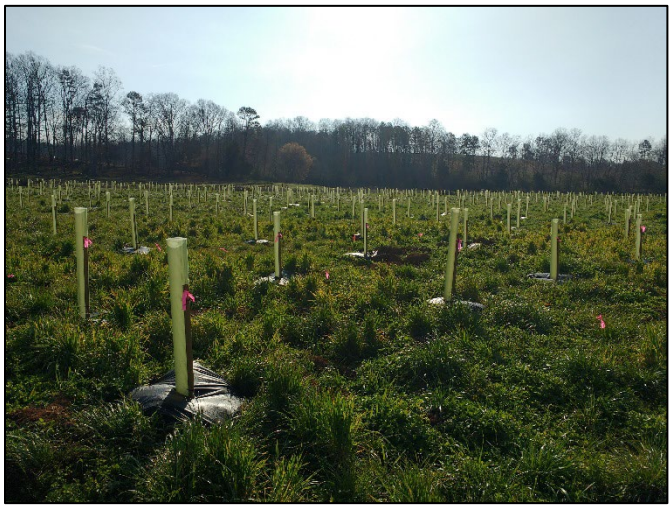
Vegetation Monitoring Plot Photos

Vegetation Plot 1 – MY-00 – 3/21/17

Vegetation Plot 1 – MY-07 – 7/11/23

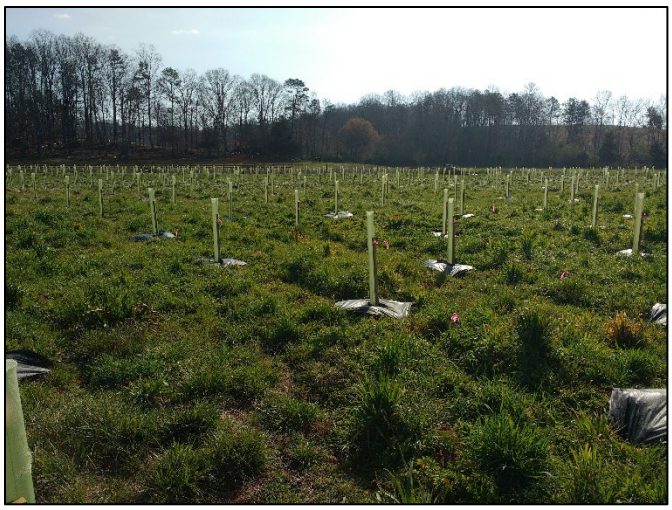
Vegetation Plot 2 – MY-00 – 3/21/17

Vegetation Plot 2 – MY-07 – 7/11/23



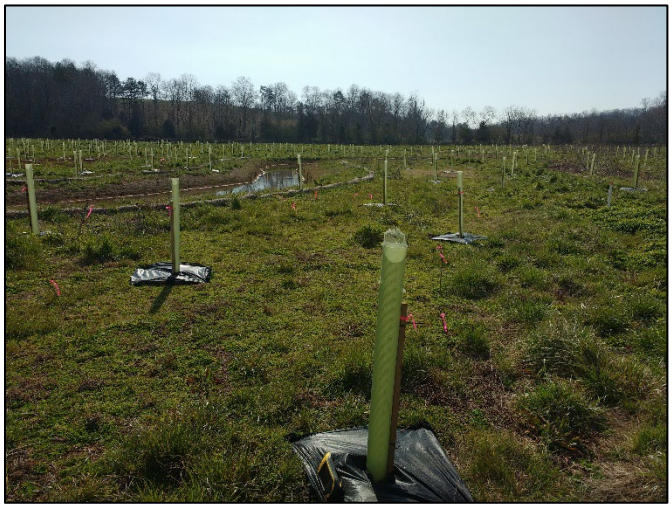
Vegetation Plot 3 – MY-00 – 3/21/17

Vegetation Plot 3 – MY-07 – 7/11/23



Vegetation Plot 4 – MY-00 – 3/21/17

Vegetation Plot 4 – MY-07 – 7/11/23



Vegetation Plot 5 – MY-00 – 3/21/17

Vegetation Plot 5 – MY-07 – 7/11/23

Vegetation Plot 6 – MY-00 – 3/21/17

Vegetation Plot 6 – MY-07 – 7/11/23

Vegetation Plot 7 – MY-00 – 3/21/17

Vegetation Plot 7 – MY-07 – 7/11/23

Vegetation Plot 8 – MY-00 – 3/21/17

Vegetation Plot 8 - MY-07 – 7/11/23

Vegetation Plot 9– MY-02 – 9/10/18

Vegetation Plot 9 - MY-07 – 7/11/23

Vegetation Plot 10– MY-02 – 9/10/18

Vegetation Plot 10 - MY-07 – 7/11/23

APPENDIX C

Vegetation Data

Table 7. Stem Count by Plot and Species
Sandy Bridge Farm Restoration Site, DMS Project #96920

	Current Plot Data (MY07 2023)															
	Plot 01		Plot 02		Plot 03		Plot 04		Plot 05		Plot 06		Plot 07		Plot 08	
Species	**Planted**	**Total**	**Planted**	**Total**	**Planted**	**Total**	**Planted**	**Total**	**Planted**	**Total**	**Planted**	**Total**	**Planted**	**Total**	**Planted**	**Total**
American Elm (*Ulmus americana*)											1	1				
Bald Cypress (*Taxodium distichum*)													10	10	2	2
Black Walnut (*Juglans nigra*)																
Black Willow (*Salix nigra*)				6				1	1	1	1	1				
Box Elder (*Acer negundo*)																
Buttonbush (*Cephalanthus occidentalis*)	3	3	1	1				1					4	4		
Eastern Cottonwood (*Populus deltoides*)					2	2			2	2			1	1		
Green Ash (*Fraxinus pennsylvanica*)															2	2
Oak (*Quercus sp.*)																
Persimmon (*Diospyros virginiana*)			1	1												
Pin Oak (*Quercus palustris*)																
Red Chokeberry (*Aronia arbutifolia*)																
Red Maple (*Acer rubrum*)			1	1			4	4							1	1
River Birch (*Betula nigra*)			3	4	4	4	3	3					1	1		
Silky Dogwood (*Cornus amomum*)	3	3	6	6					4	4	1	1			3	3
Smooth Sumac (*Rhus glabra*)																
Sugarberry (*Celtis laevigata*)																
Swamp Chestnut Oak (*Quercus michauxii*)																
Sycamore (*Platanus occidentalis*)	1	1	1	2									1	2		
Tulip Poplar (*Liriodendron tulipifera*)																
Water Tupelo (*Nyssa aquatica*)																
Willow Oak (*Quercus phellos*)					2	2					1	1				
Witch Hazel (*Hamamelis virginiana*)																
Unknown																
Stem count	7	7	13	21	8	8	7	9	7	7	4	4	17	18	8	8
size (ares)	1		1		1		1		1		1		1		1	
size (ACRES)	0.025		0.025		0.025		0.025		0.025		0.025		0.025		0.025	
Species count	3	3	6	7	3	3	2	4	3	3	4	4	5	5	4	4
Stems per ACRE	283	283	526	850	324	324	283	364	283	283	162	162	688	728	324	324

Table 7. Stem Count by Plot and Species
Sandy Bridge Farm Restoration Site, DMS Project #96920

	Current Plot Data (MY07 2023)				Annual Means											
	Plot 09		Plot 10		MY7 (2023)		MY5 (2021)		MY03 (2019)		MY02 (2018)		MY01 (2017)		MY00 (2017)	
Species	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total
American Elm (*Ulmus americana*)			2	2	3	3	3	4	6	7	6	6	7	7		
Bald Cypress (*Taxodium distichum*)					12	12	11	11					1	1		
Black Walnut (*Juglans nigra*)												1				
Black Willow (*Salix nigra*)					2	9		14		2		8		1		
Box Elder (*Acer negundo*)		3		7		10		8		15	8	8	9	9		
Buttonbush (*Cephalanthus occidentalis*)	1	1			9	10	10	17	8	10	9	9	16	16		
Eastern Cottonwood (*Populus deltoides*)					5	5	5	6	7	8	13	13				
Green Ash (*Fraxinus pennsylvanica*)	11	11	1	1	14	14	14	14	14	14					4	4
Oak (*Quercus sp.*)							1	1			1	1				
Persimmon (*Diospyros virginiana*)					1	1	1	1	1	1	2	2	2	2		
Pin Oak (*Quercus palustris*)											6	6	2	2		
Red Chokeberry (*Aronia arbutifolia*)	4	4			4	4	4	4	6	6	6	6	9	9		
Red Maple (*Acer rubrum*)		1			6	7	6	7	6	8	11	12	11	11		
River Birch (*Betula nigra*)					11	12	10	12	11	14	21	22	13	13		
Silky Dogwood (*Cornus amomum*)	4	4	1	1	22	22	17	18	20	24			1	2		
Smooth Sumac (*Rhus glabra*)											3	4	4	4		
Sugarberry (*Celtis laevigata*)									3	3	10	10	3	3		
Swamp Chestnut Oak (*Quercus michauxii*)	2	2	6	6	8	8	8	8	10	10	5	12	3	5		
Sycamore (*Platanus occidentalis*)	1	8	2	2	6	15	4	10	5	10	1	1	6	6	1	1
Tulip Poplar (*Liriodendron tulipifera*)									1	1	7	7	6	6		
Water Tupelo (*Nyssa aquatica*)							1	1					1	1		
Willow Oak (*Quercus phellos*)	1	1			4	4	4	4	6	6						
Witch Hazel (*Hamamelis virginiana*)																
Unknown													3	3	139	139
Stem count	24	35	12	19	107	136	99	140	104	139	109	128	97	101	144	144
size (ares)	1		1		10		10		10		10		10		10	
size (ACRES)	0.025		0.025		0.25		0.25		0.25		0.25		0.25		0.25	
Species count	7	9	5	6	14	15	15	17	14	16	15	17	16	17	2	2
Stems per ACRE	971	1416	486	769	433	550	401	567	421	563	441	518	393	409	583	583

APPENDIX D

Stream Measurement and Geomorphology Data

Table 8. Baseline Stream Data Summary
Sandy Bridge Farm Stream Restoration Site, DMS Project #96920

Parameter	Pre-Existing Condition					Reference Reach(es) Data					Design	As-built			
Dimension - Riffle	Min	Mean	Med	Max	n	Min	Mean	Med	Max	n	Proposed	Min	Mean	Max	n
Bankfull Width (ft)	31.5	32.9	330	34.0	4	14.8	16.7		18.6	2	15.0	15.4	17.2	18.9	2
Floodprone Width (ft)	60.9	72.9	69.3	92.0	4	>40	>47		>55	2	>38	>60	>68	>70	2
Bankfull Mean Depth (ft)	2.1	2.2	2.2	2.5	4	1.3	1.5		1.7	2	0.9	0.7	0.8	0.9	2
Bankfull Max Depth (ft)	3.1	3.4	3.4	3.7	4	1.9	2.2		2.4	2	1.3	1.5	1.5	1.5	2
Bankfull Cross-Sectional Area (ft^2)	66.6	73.2	71.2	84.0	4	25.0	25.1		25.1	2	12.7	13.2	13.5	13.8	2
Width/Depth Ratio	13.5	14.8	14.9	16.0	4	8.8	11.3		13.8	2	17.7	17.3	22.1	27.0	2
Entrenchment Ratio	1.9	2.2	2.2	2.7	4	>2.5	>2.5		>2.5	2	>2.5	3.8	4.0	4.1	2
Bank Height Ratio	1.1	1.4	1.3	1.7	4	1.2	1.4		1.5	2	1.0	1.0	1.0	1.0	2
Pattern															
Channel Beltwidth (ft)	*					60				1	35-60	35		60	2
Radius of Curvature (ft)	*					16			87	1	30-50	30		50	2
Rc:Bankfull width (ft/ft)	*					0.9			5.9	1	2.0-3.3	2.0		3.3	2
Meander Wavelength (ft)	*					66			191	1	134-160	134		160	2
Meander Width Ratio	*					4.1				1	8.9-10.7	8.9		10.7	2
Riffle Length (ft)												23	40	56	20
Riffle Slope (ft/ft)	0.000			0.010	2	0.013			0.035	2	0.002-0.008	0.000	0.006	0.014	20
Pool Length (ft)	*					14			33	2	17-55	11	22	39	20
Pool Spacing (ft)	*					50			105	2	55-90	25.9	78.3	102.2	19
Substrate and Transport Parameters															
SC% / Sa% / G% / C% / B% / Be%	18%/39%/43%/1%/0%/0%											66%/2%/22%/10%/1%/0%			
d16 / d35 / d50 / d84 / d95 (mm)	0.076/1.2/3.3/5.2/9.4/18											0.062/0.5/17.5/25.5/40/90			
Channel length (ft)	1,470										1,626	1,626			
Drainage Area (SM)	1.31					1.49					1.31	1.31			
Rosgen Classification	E4-G4					C4					C4	C4			
Sinuosity	1.0					1.3					1.2	1.2			
Water Surface Slope (ft/ft)	0.0043					0.0050					0.0038	0.0027			

*No data shown due to channelization/lack of bed diversity

Table 9. Cross-Section Morphology Data Tables
Sandy Bridge Farm Stream Restoration Site, DMS Project #96920

Dimension and Substrate	Cross-Section 1 (Riffle) Station 14+75							Cross-Section 2 (Pool) Station 16+40						
	Base	MY1	MY2	MY3	MY4	MY5	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY7
Bankfull Elevation	866.7	866.9	867.3	867.4	867.9	867.8	868.0	866.7	866.7	867.5	867.7	868.2	868.5	868.8
Bankfull Width (ft)	15.4	15.7	18.1	13.8	9.9	10.5	10.5	18.8	19.6	18.6	21.0	13.6	13.5	13.4
Floodprone Width (ft)	>80	>80	>80	>80	>80	>80	>80	-	-	-	-	-	-	-
Bankfull Mean Depth (ft)	0.9	0.9	0.8	1.0	1.4	1.3	1.3	1.4	1.4	1.4	1.3	2.0	2.0	2.0
Bankfull Max Depth (ft)	1.5	1.7	2.0	2.1	2.2	2.1	1.9	2.7	2.7	2.2	2.7	2.4	2.5	2.9
Bankfull Cross-Sectional Area (ft^2)	13.8	13.8	13.8	13.8	13.8	13.8	13.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8
Total Cross-Sectional Area (ft^2)	13.8	10.9	7.2	7.1	4.8	4.2	2.9	26.8	26.2	12.9	10.9	7.4	4.1	3.0
Bankfull Width/Depth Ratio	17.3	17.9	23.6	13.4	7.1	8.1	7.9	-	-	-	-	-	-	-
Bankfull Entrenchment Ratio	4.1	5.1	4.4	5.9	6.9	9.3	6.7	-	-	-	-	-	-	-
Bankfull Bank Height Ratio	1.0	1.0	0.8	0.8	1.0	1.1	0.8	-	-	-	-	-	-	-
d50 (mm)	35	26	0.7	0.6	4.4	0.6	-	-	-	-	-	-	-	-
	Cross-Section 3 (Riffle) Station 101+73							Cross-Section 4 (Pool) Station 105+67						
	Base	MY1	MY2	MY3	MY4	MY5	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY7
Bankfull Elevation	865.3	865.3	865.2	865.2	865.2	865.4	865.3	865.3	865.16	865.1	865.4	865.6	865.8	866.0
Bankfull Width (ft)	15.7	17.3	15.4	16.7	16.2	15.6	16.4	18.7	18.1	17.1	20.4	35.1	20.5	20.1
Floodprone Width (ft)	>70	>70	>70	>70	>70	>70	>70	-	-	-	-	-	-	-
Bankfull Mean Depth (ft)	0.8	0.8	0.9	0.8	0.8	0.8	0.8	1.5	1.6	1.7	1.4	0.8	1.4	1.4
Bankfull Max Depth (ft)	1.5	1.6	1.6	1.7	1.7	1.5	1.7	3.0	3.1	3.0	1.9	1.6	2.3	2.4
Bankfull Cross-Sectional Area (ft^2)	13.1	13.1	13.1	13.1	13.1	13.1	13.1	28.8	28.8	28.8	28.8	28.8	28.8	28.8
Total Cross-Sectional Area (ft^2)	13.1	12.4	15.1	15.1	14.4	12.2	12.5	28.8	30.7	32.1	20.7	17.8	18.1	13.3
Bankfull Width/Depth Ratio	18.8	22.8	18.0	19.7	20.0	18.5	20.6	-	-	-	-	-	-	-
Bankfull Entrenchment Ratio	4.6	4.2	4.7	4.5	4.5	4.7	4.4	-	-	-	-	-	-	-
Bankfull Bank Height Ratio	1.0	1.0	1.0	0.9	1.0	0.8	0.9	-	-	-	-	-	-	-
d50 (mm)	0.062	0.062	0.062	0.062	0.52	0.24	-	-	-	-	-	-	-	-

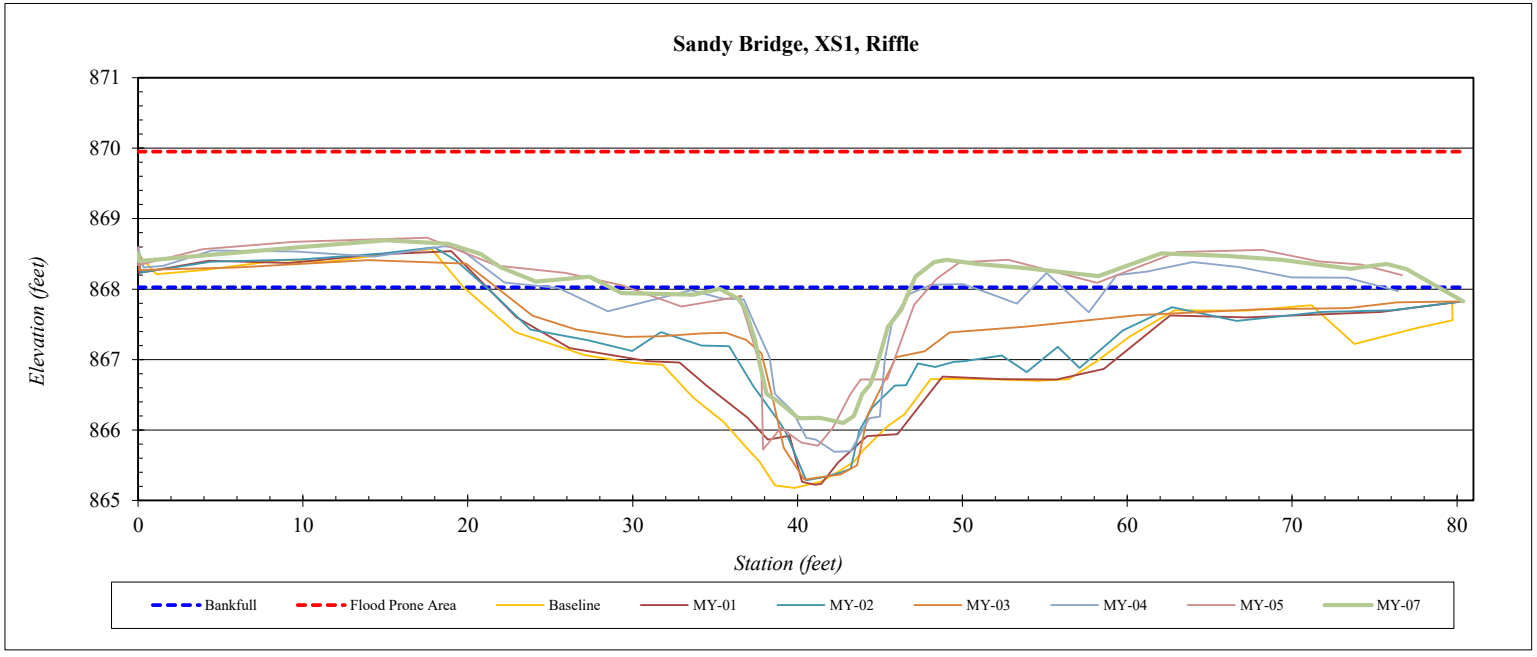
Calculations are based on a fixed bankfull area established during the baseline survey, and the resulting bankfull elevation. Total Cross-Sectional Area represents the cross-sectional area measured from the baseline bankfull elevation.

Cross-Section Plots

River Basin:	Broad
Site:	Sandy Bridge
XS ID	XS1
Drainage Area:	837 acres
Date:	9/7/2023
Field Crew:	Kelsey B, Caleb K, Tommy S

Station	Elevation
0.0	868.51
0.1	868.40
9.7	868.60
15.0	868.69
18.8	868.64
20.8	868.50
22.0	868.31
24.1	868.11
27.4	868.18
29.3	867.95
33.7	867.92
35.3	868.00
36.4	867.86
36.8	867.72
37.4	867.29
37.7	866.91
38.1	866.51
38.9	866.40
40.1	866.17
41.4	866.17
42.8	866.10
43.4	866.20
43.9	866.51
44.4	866.64
44.8	866.87
45.5	867.46
46.3	867.70
47.1	868.18
48.3	868.39
49.0	868.42
50.87	868.36
53.65	868.30
58.25	868.18
62.05	868.51
66.07	868.47
69.34	868.42
73.55	868.29
75.73	868.36
76.94	868.29
80.37	867.83

SUMMARY DATA	
Current Bankfull Elevation:	868.03
Bankfull Cross-Sectional Area:	13.8
Total Cross-Sectional Area:	2.9
Bankfull Width:	10.5
Flood Prone Area Elevation:	870.0
Flood Prone Width:	70.4
Max Depth at Bankfull:	1.9
Mean Depth at Bankfull:	1.3
W / D Ratio:	7.9
Entrenchment Ratio:	6.7
Bank Height Ratio:	0.8

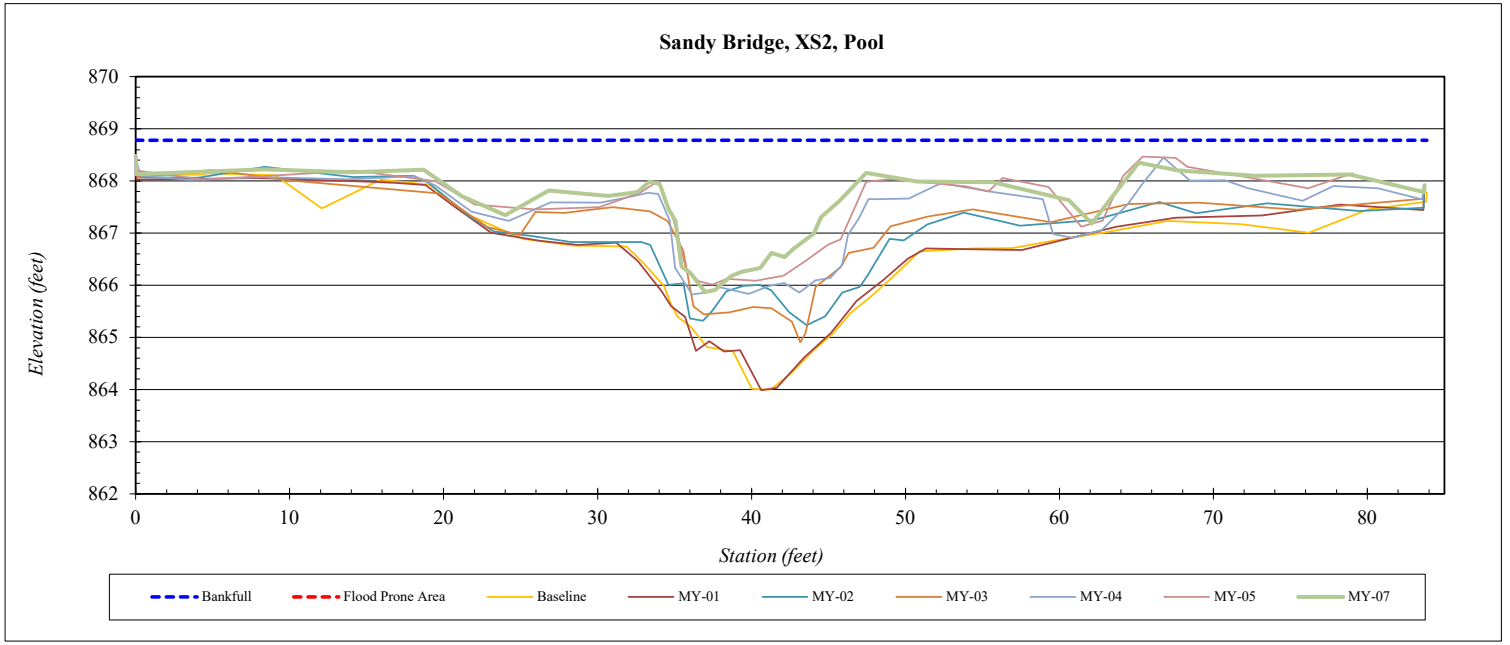


Cross-Section Plots

River Basin:	Broad
Site:	Sandy Bridge
XS ID	XS2
Drainage Area:	837 acres
Date:	9/7/2023
Field Crew:	Kelsey B, Caleb K, Tommy S

Station	Elevation
0.0	868.48
0.0	868.13
8.3	868.22
14.0	868.17
18.7	868.22
21.2	867.71
24.0	867.35
26.8	867.82
30.7	867.71
32.6	867.79
33.4	867.99
34.1	867.94
34.6	867.48
35.1	867.23
35.5	866.36
36.0	866.24
37.0	865.87
37.6	865.91
38.0	866.02
38.7	866.18
39.4	866.26
40.6	866.33
41.3	866.62
42.1	866.54
42.8	866.71
44.0	866.99
44.5	867.31
45.7	867.61
47.4	868.16
50.8	867.99
55.7	867.98
60.6	867.64
62.1	867.18
63.4	867.68
65.16	868.35
67.69	868.21
72.70	868.10
78.88	868.13
83.69	867.79
83.71	867.92

SUMMARY DATA	
Current Bankfull Elevation:	868.78
Bankfull Cross-Sectional Area:	26.8
Total Cross-Sectional Area:	3.0
Bankfull Width:	13.4
Flood Prone Area Elevation:	---
Flood Prone Width:	---
Max Depth at Bankfull:	2.9
Mean Depth at Bankfull:	2.0
W / D Ratio:	---
Entrenchment Ratio:	---
Bank Height Ratio:	---

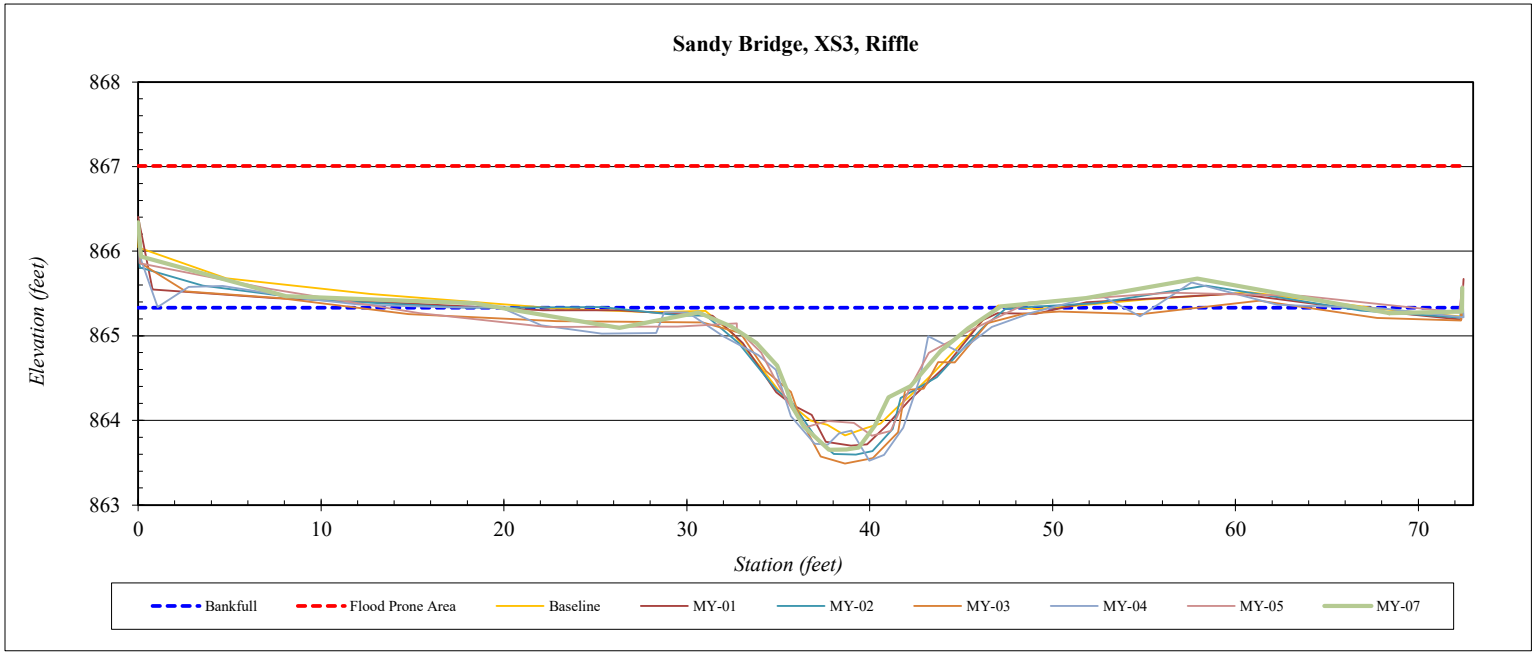


Cross-Section Plots

River Basin:	Broad
Site:	Sandy Bridge
XS ID	XS3
Drainage Area:	837 acres
Date:	9/7/2023
Field Crew:	Kelsey B, Caleb K, Tommy S

Station	Elevation
0.0	866.34
0.1	865.94
8.1	865.47
18.4	865.38
26.3	865.09
30.6	865.28
31.3	865.21
32.4	865.11
33.8	864.92
34.9	864.65
35.5	864.36
35.8	864.16
36.4	863.93
37.8	863.65
38.7	863.66
39.4	863.68
40.3	863.93
41.0	864.27
42.2	864.41
43.9	864.82
45.4	865.09
47.2	865.35
51.8	865.45
57.9	865.67
64.2	865.43
68.4	865.27
68.4	865.27
72.38	865.29
72.39	865.57

SUMMARY DATA	
Current Bankfull Elevation:	865.33
Bankfull Cross-Sectional Area:	13.1
Total Cross-Sectional Area:	12.5
Bankfull Width:	16.4
Flood Prone Area Elevation:	867.0
Flood Prone Width:	72.4
Max Depth at Bankfull:	1.7
Mean Depth at Bankfull:	0.8
W / D Ratio:	20.6
Entrenchment Ratio:	4.4
Bank Height Ratio:	0.9

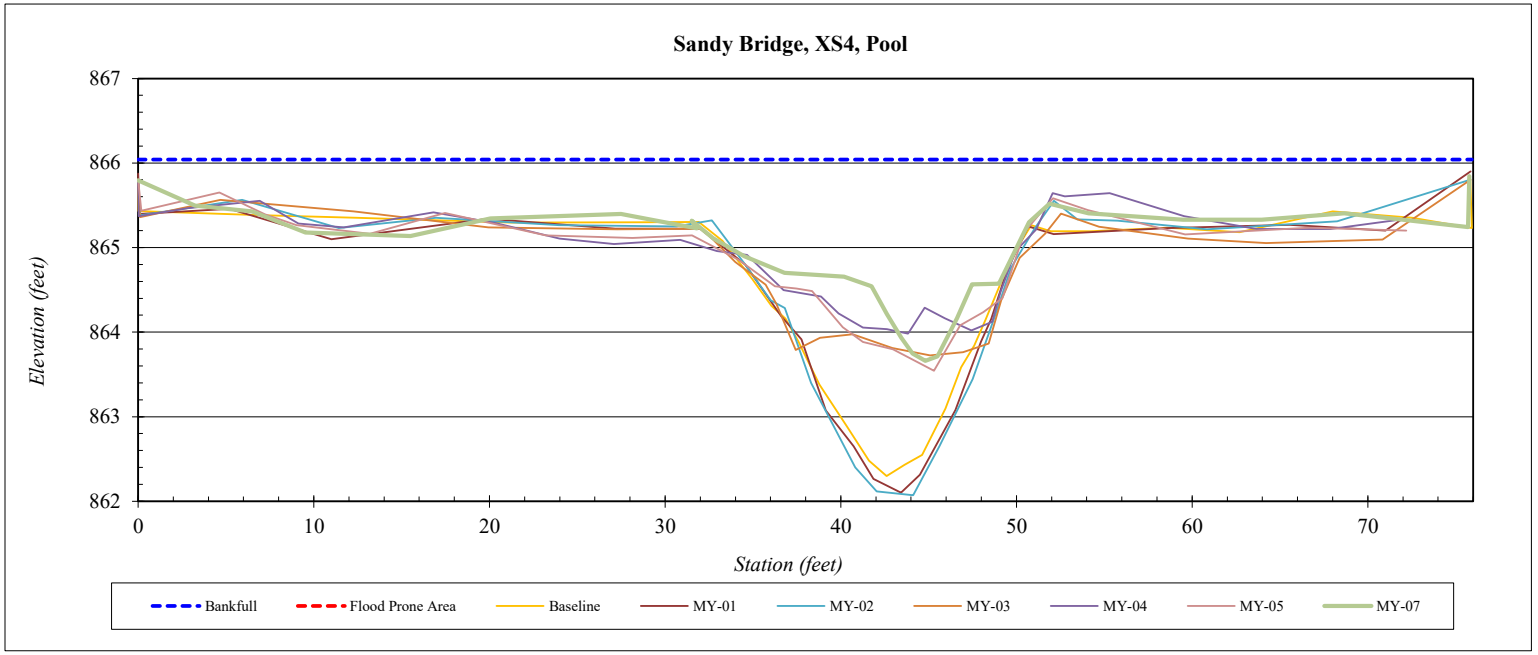


Cross-Section Plots

River Basin:	Broad
Site:	Sandy Bridge
XS ID	XS4
Drainage Area:	837 acres
Date:	9/7/2023
Field Crew:	Kelsey B, Caleb K, Tommy S

Station	Elevation
0.0	865.79
3.2	865.50
6.5	865.43
9.5	865.18
15.5	865.14
20.1	865.34
27.5	865.40
31.8	865.23
31.5	865.32
32.7	865.11
34.5	864.90
36.8	864.70
40.2	864.66
41.8	864.54
42.6	864.21
43.5	863.93
44.1	863.75
44.8	863.66
45.5	863.71
46.6	864.17
47.5	864.56
49.0	864.57
50.7	865.30
51.9	865.52
54.1	865.41
59.5	865.33
63.96	865.33
68.66	865.41
72.16	865.33
75.71	865.24
75.77	865.85

SUMMARY DATA	
Current Bankfull Elevation:	866.04
Bankfull Cross-Sectional Area:	28.8
Total Cross-Sectional Area:	13.3
Bankfull Width:	20.1
Flood Prone Area Elevation:	---
Flood Prone Width:	---
Max Depth at Bankfull:	2.4
Mean Depth at Bankfull:	1.4
W / D Ratio:	---
Entrenchment Ratio:	---
Bank Height Ratio:	---



APPENDIX D

Hydrologic Data

Sandy Bridge Farm Restoration Site
30-70 Percentile Graph
WETS Station Name: Lake Lure 2, NC

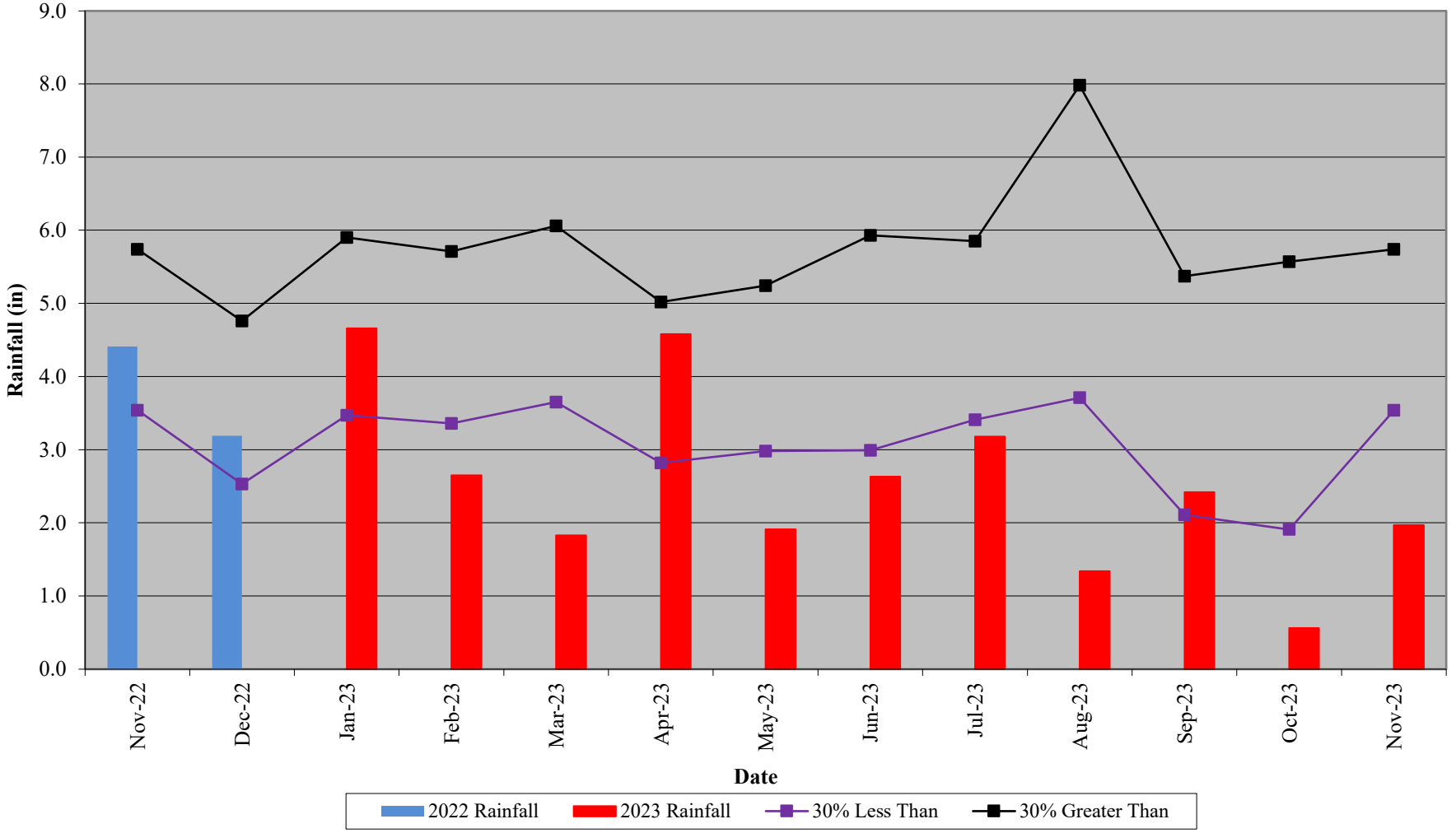


Table 10. Verification of Bankfull Events Sandy Bridge Farm Restoration Site, DMS Project #96920		
Date of Occurrence	**Method**	**Photo Number**
April 6, 2017	Onsite stream gauge	
April 24, 2017	Onsite stream gauge	
May 29, 2017	Onsite stream gauge	
August 3, 2017	Onsite stream gauge	
August 14, 2017	Onsite stream gauge	
August 15, 2017	Onsite stream gauge	
September 5, 2017	Onsite stream gauge	
October 23, 2017	Onsite stream gauge, photos taken on site	1
February 7, 2018	Onsite stream gauge, photos taken on site	2
February 11, 2018	Onsite stream gauge	
April 15, 2018	Onsite stream gauge	
April 24, 2018	Onsite stream gauge	
May 19, 2018	Onsite stream gauge	
May 30, 2018	Onsite stream gauge	
September 16, 2018	Onsite stream gauge	
October 11, 2018	Onsite stream gauge	3
January 4, 2019	Onsite stream gauge	
January 20, 2019	Onsite stream gauge	
January 24, 2019	Onsite stream gauge	
February 18, 2019	Onsite stream gauge	
February 21, 2019	Onsite stream gauge	
February 22, 2019	Onsite stream gauge	
April 8, 2019	Onsite stream gauge	
May 11, 2019	Onsite stream gauge	
June 18, 2019	Onsite stream gauge	
October 31, 2019	Onsite stream gauge	
January 12, 2020	Onsite stream gauge	
January 24, 2020	Onsite stream gauge	
February 6, 2020	Onsite stream gauge	
February 13, 2020	Onsite stream gauge	
March 25, 2020	Onsite stream gauge	
April 13, 2020	Onsite stream gauge	
January 1, 2021	Onsite stream gauge	
February 15, 2021	Onsite stream gauge	
March 18, 2021	Onsite stream gauge	
March 26, 2021	Onsite stream gauge	
March 31, 2021	Onsite stream gauge	
April 10, 2021	Onsite stream gauge	
August 17, 2021	Onsite stream gauge	4
March 23, 2022	Onsite stream gauge	
April 18, 2022	Onsite stream gauge	
May 27, 2022	Onsite stream gauge	
April 28, 2023	Onsite stream gauge	
May 28, 2023	Onsite stream gauge	
June 22, 2023	Onsite stream gauge	

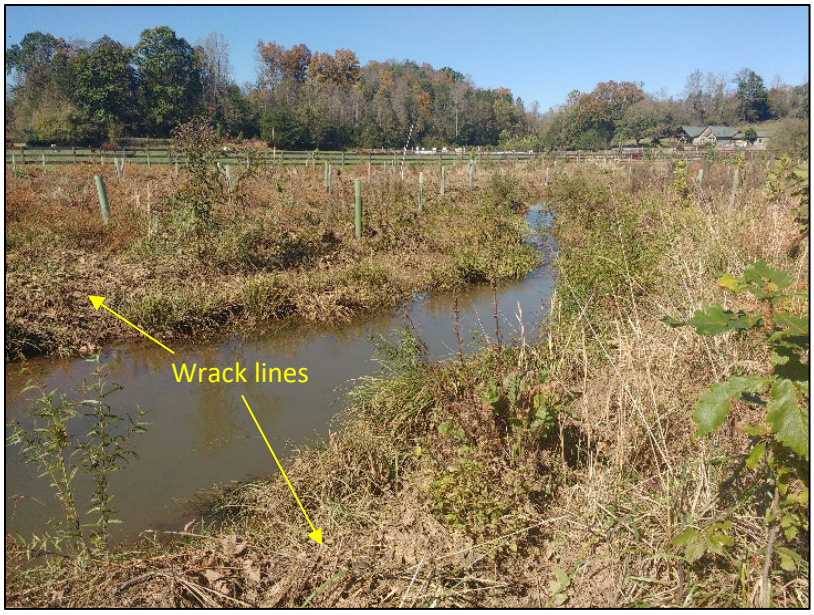
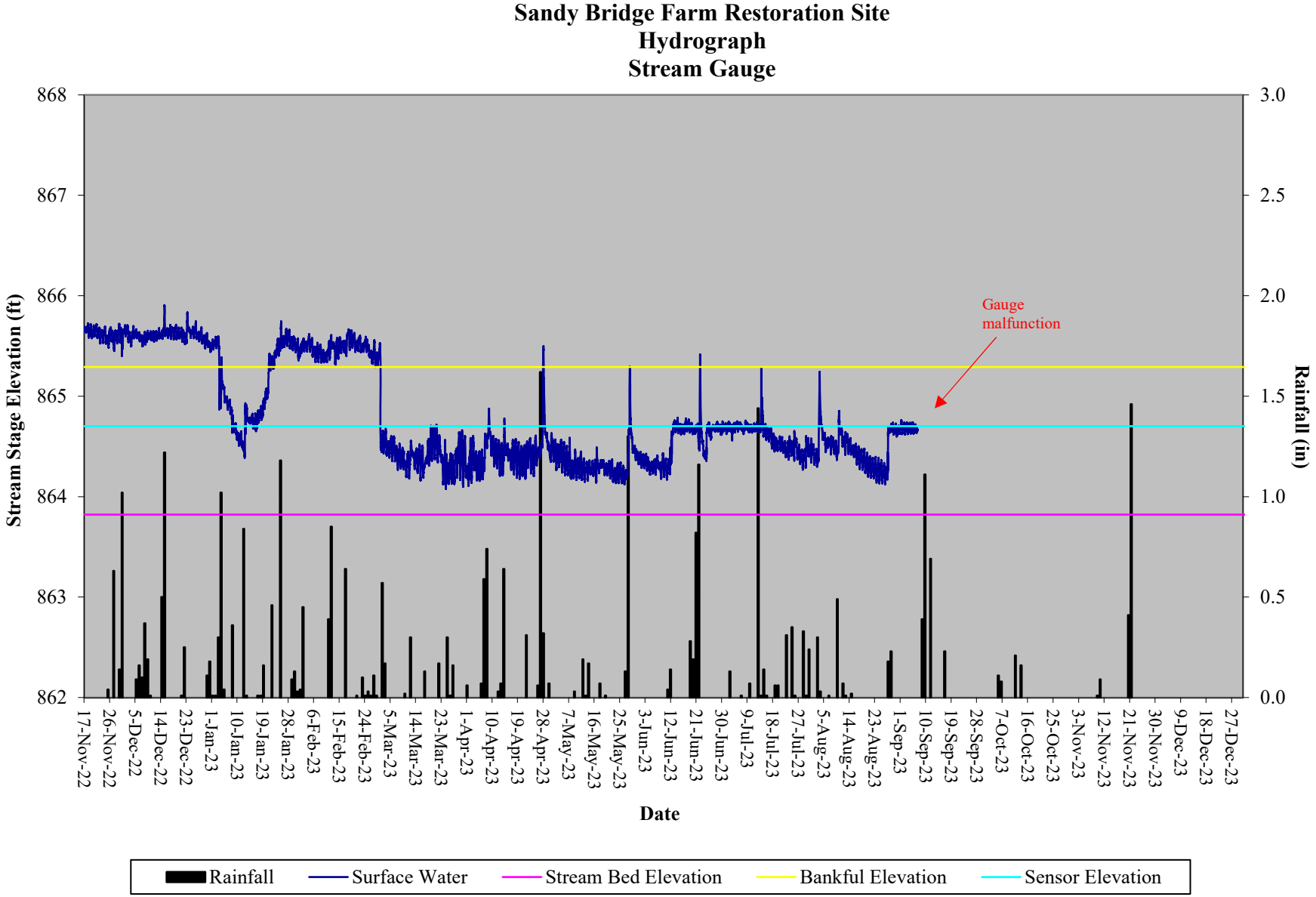


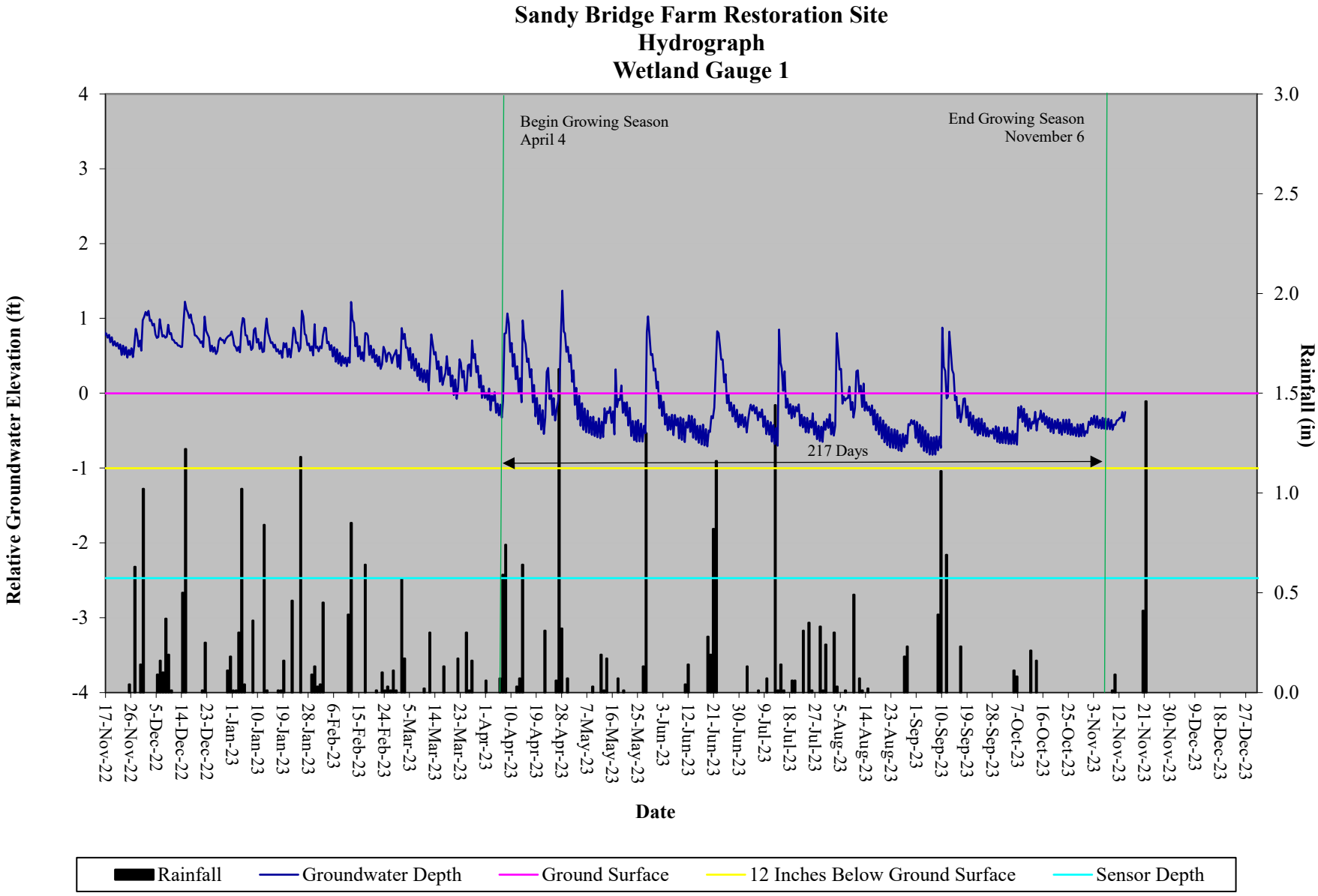
Photo 1. Sediment on plants and wrack lines above bankfull, 10/26/2017

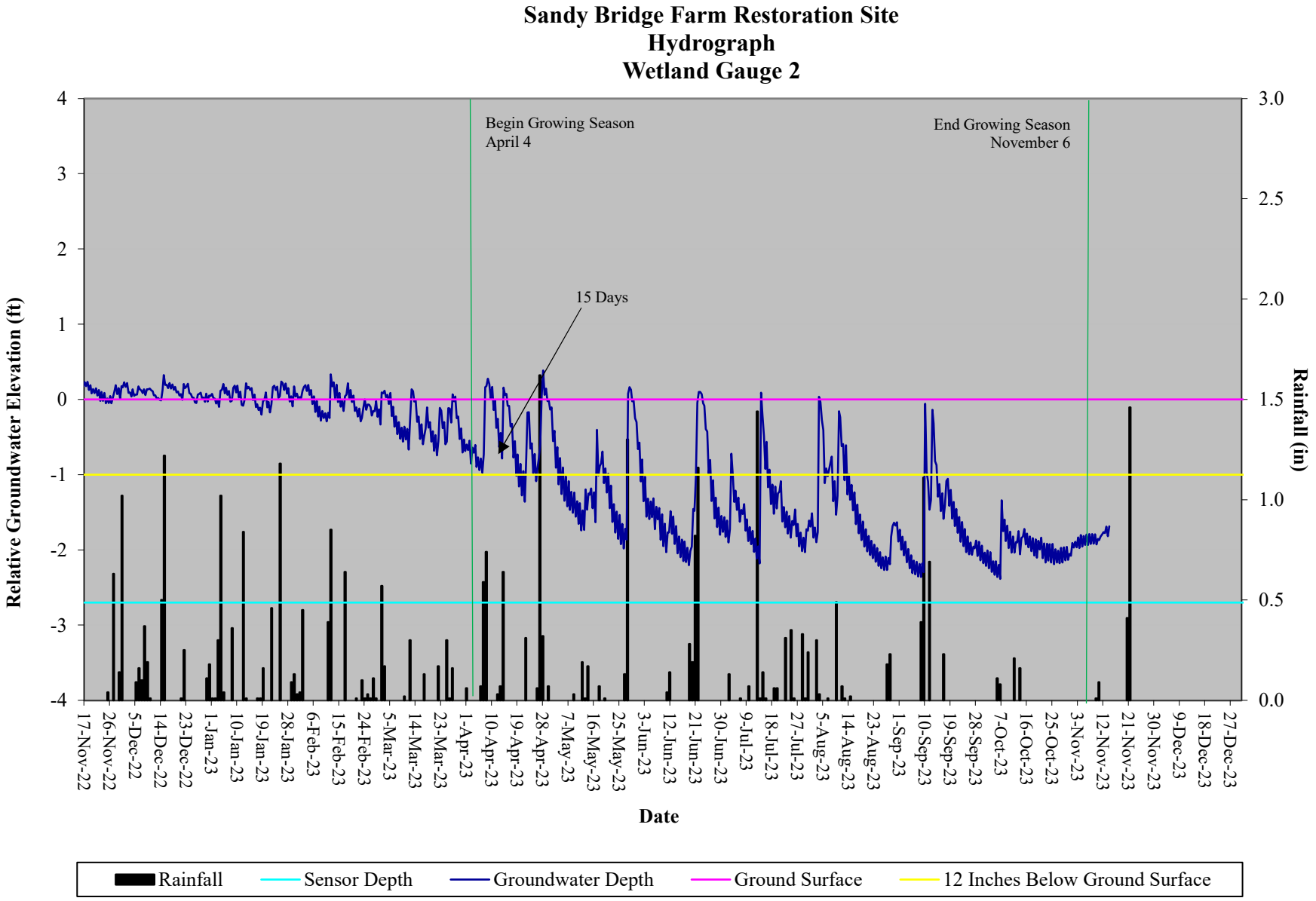

Photo 2. Bankfull event on site, 2/7/2018

Photo 3. Wrack lines above bankfull, 11/7/2018

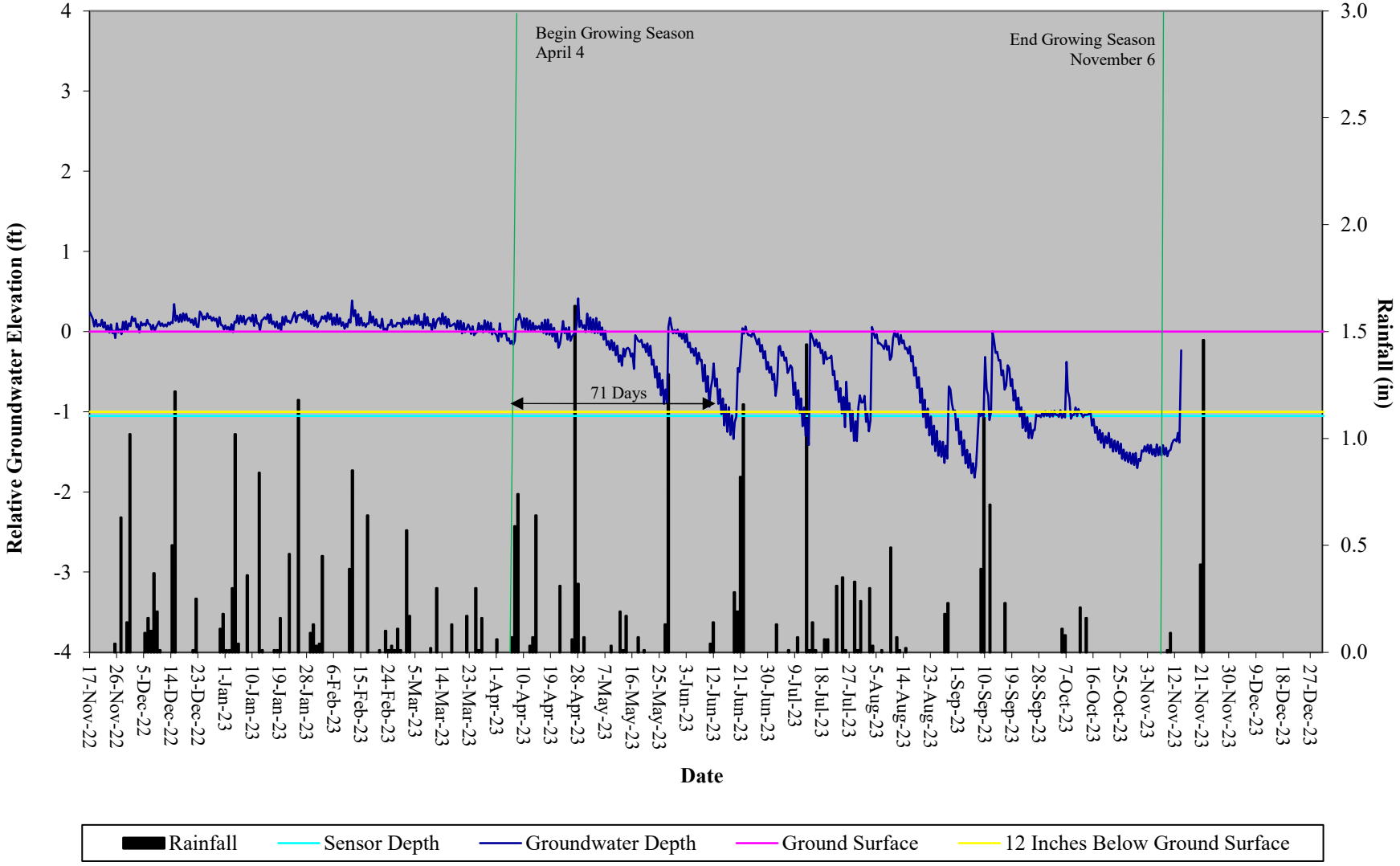
Photo 4. Wrack lines above bankfull, 9/13/2021

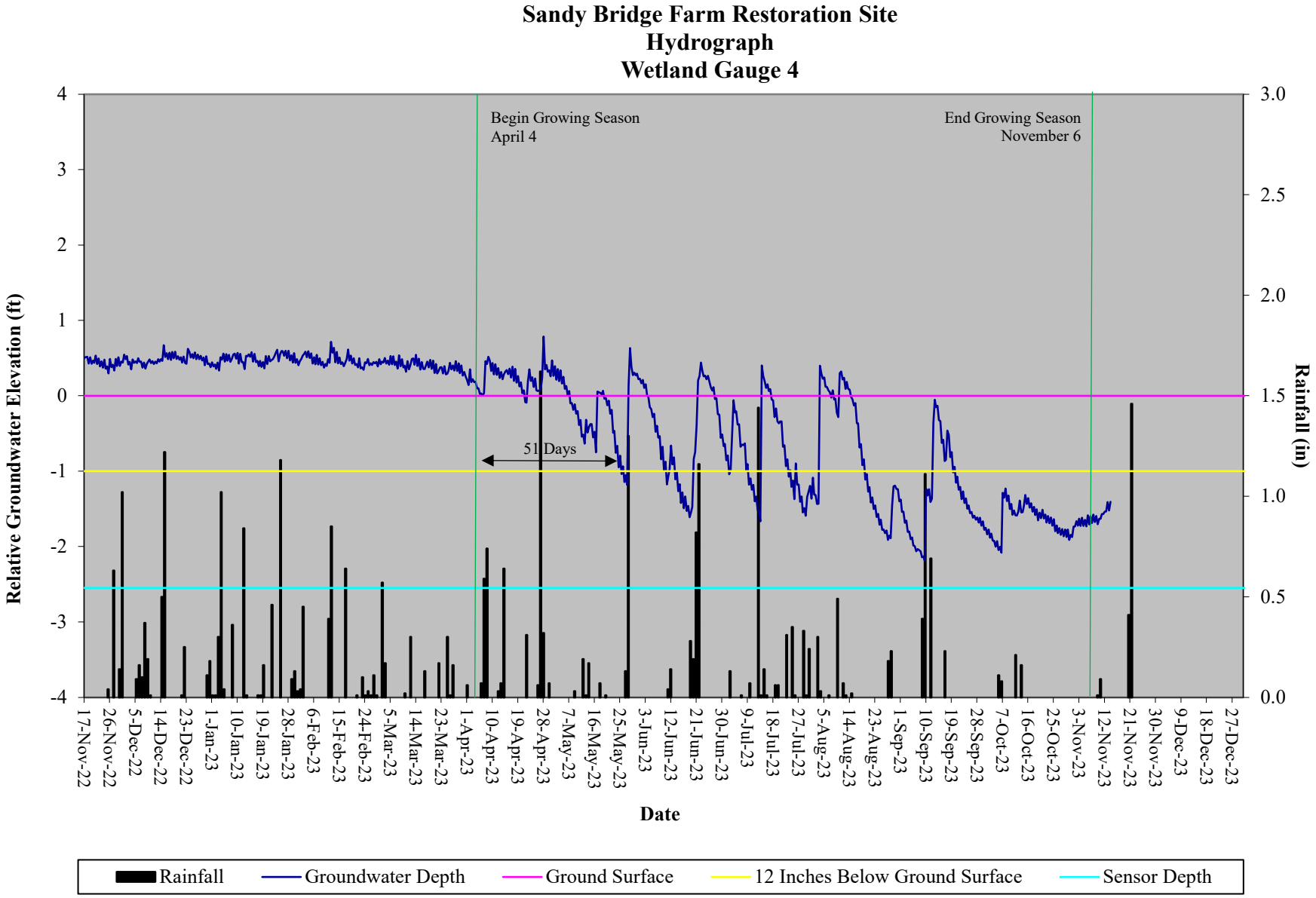

Sandy Bridge Farm Restoration Site
Hydrograph
Stream Gauge
Stream Stage Elevation (ft)
Rainfall (in)
Date
Gauge malfunction
868
867
866
865
864
863
862
3.0
2.5
2.0
1.5
1.0
0.5
0.0
17-Nov-22
26-Nov-22
5-Dec-22
14-Dec-22
23-Dec-22
1-Jan-23
10-Jan-23
19-Jan-23
28-Jan-23
6-Feb-23
15-Feb-23
24-Feb-23
5-Mar-23
14-Mar-23
23-Mar-23
1-Apr-23
10-Apr-23
19-Apr-23
28-Apr-23
7-May-23
16-May-23
25-May-23
3-Jun-23
12-Jun-23
21-Jun-23
30-Jun-23
9-Jul-23
18-Jul-23
27-Jul-23
5-Aug-23
14-Aug-23
23-Aug-23
1-Sep-23
10-Sep-23
19-Sep-23
28-Sep-23
7-Oct-23
16-Oct-23
25-Oct-23
3-Nov-23
12-Nov-23
21-Nov-23
30-Nov-23
9-Dec-23
18-Dec-23
27-Dec-23
Rainfall
Surface Water
Stream Bed Elevation
Bankful Elevation
Sensor Elevation


Sandy Bridge Farm Restoration Site
Hydrograph
Wetland Gauge 1
Begin Growing Season
April 4
End Growing Season
November 6
217 Days
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth

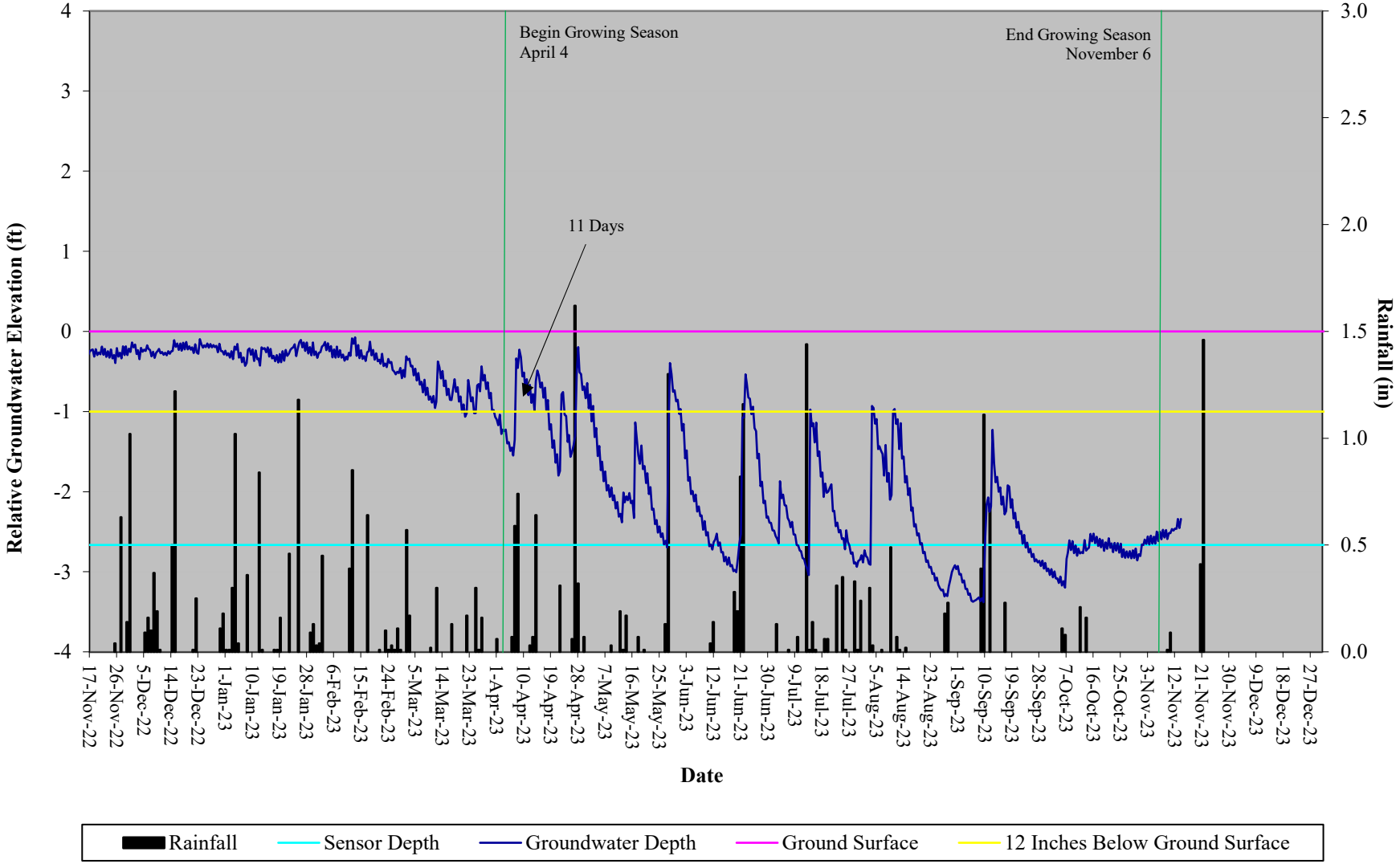

Sandy Bridge Farm Restoration Site
Hydrograph
Wetland Gauge 2
Begin Growing Season
April 4
End Growing Season
November 6
15 Days
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Sensor Depth
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface

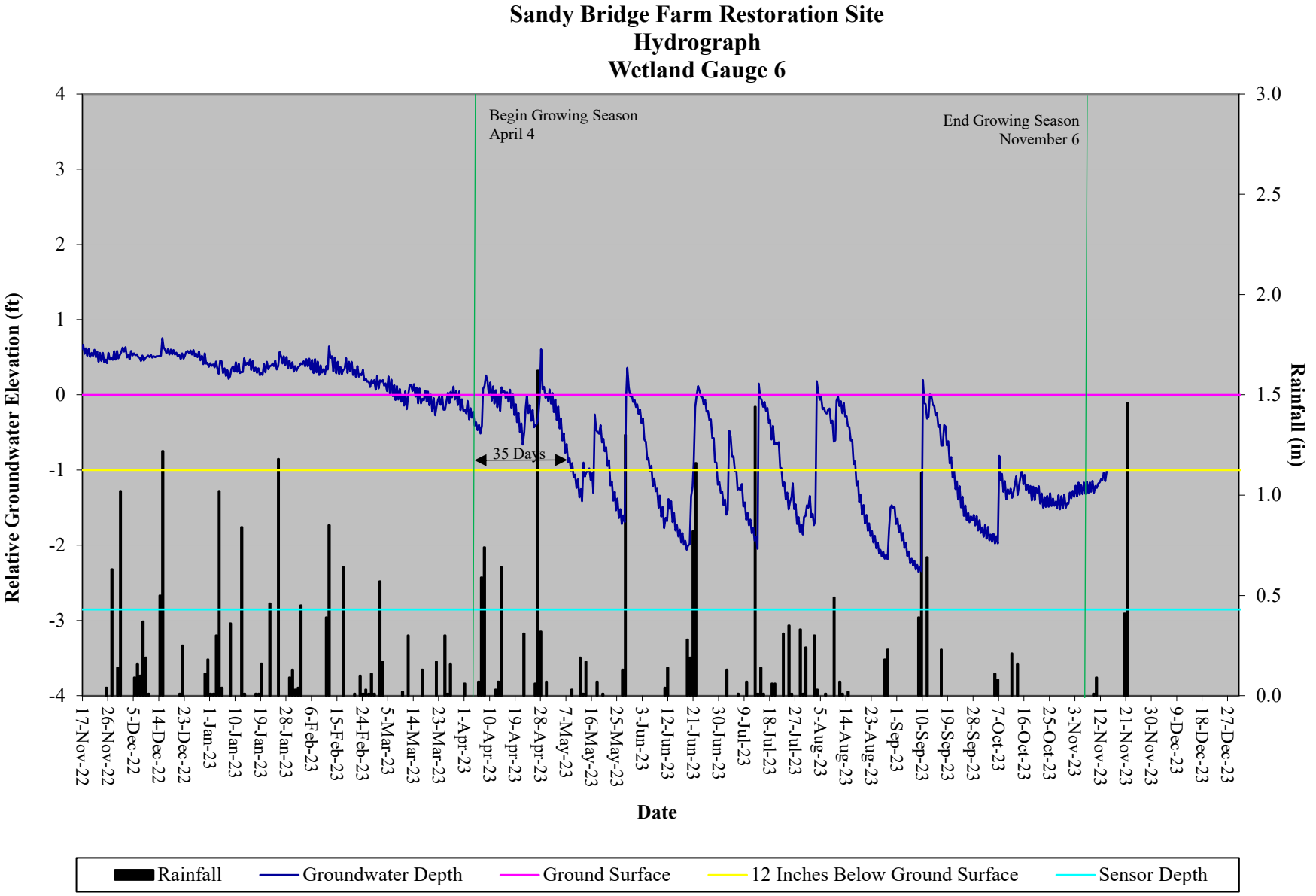
Sandy Bridge Farm Restoration Site
Hydrograph
Wetland Gauge 3

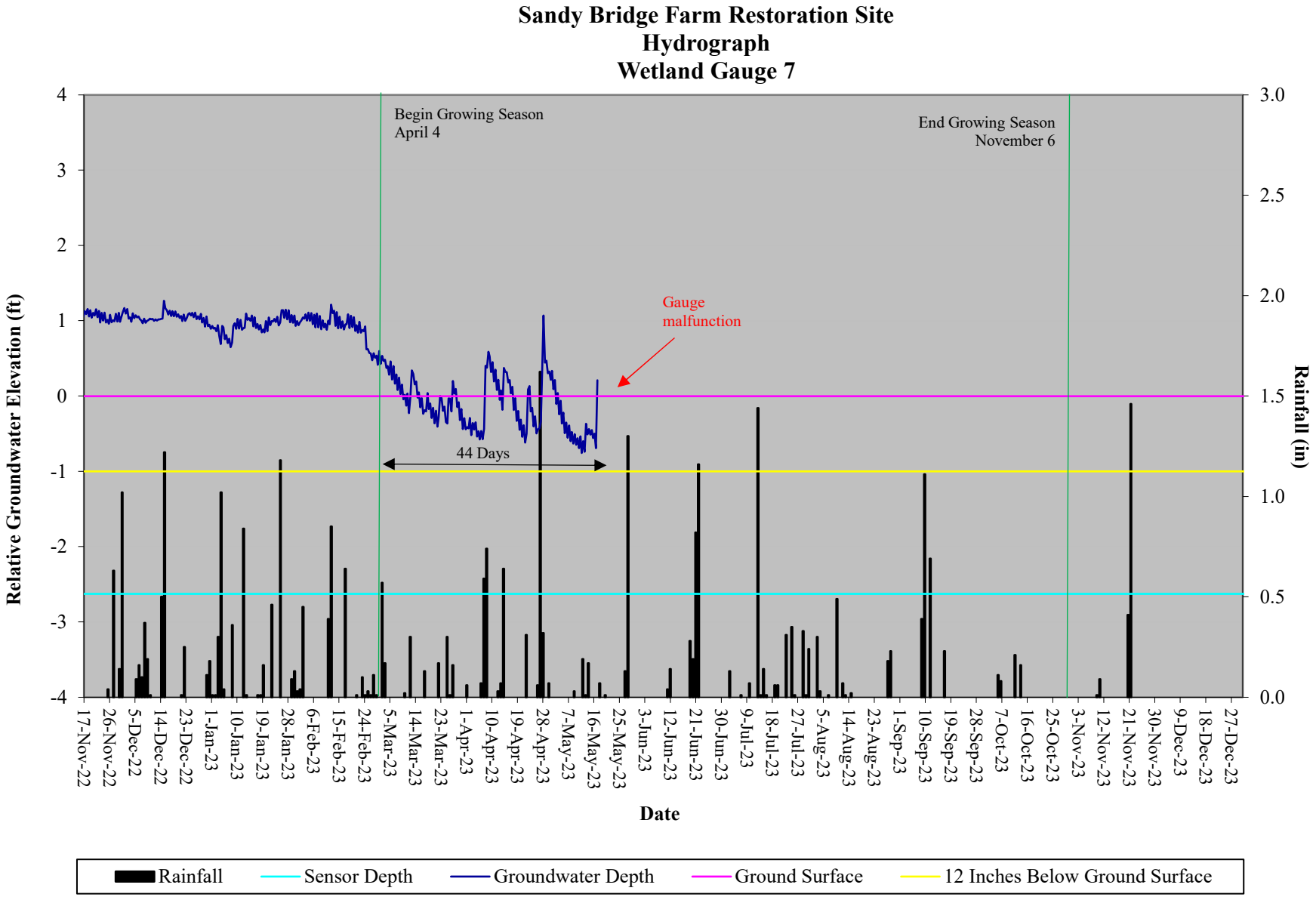



Sandy Bridge Farm Restoration Site
Hydrograph
Wetland Gauge 4
Begin Growing Season
April 4
End Growing Season
November 6
51 Days
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth

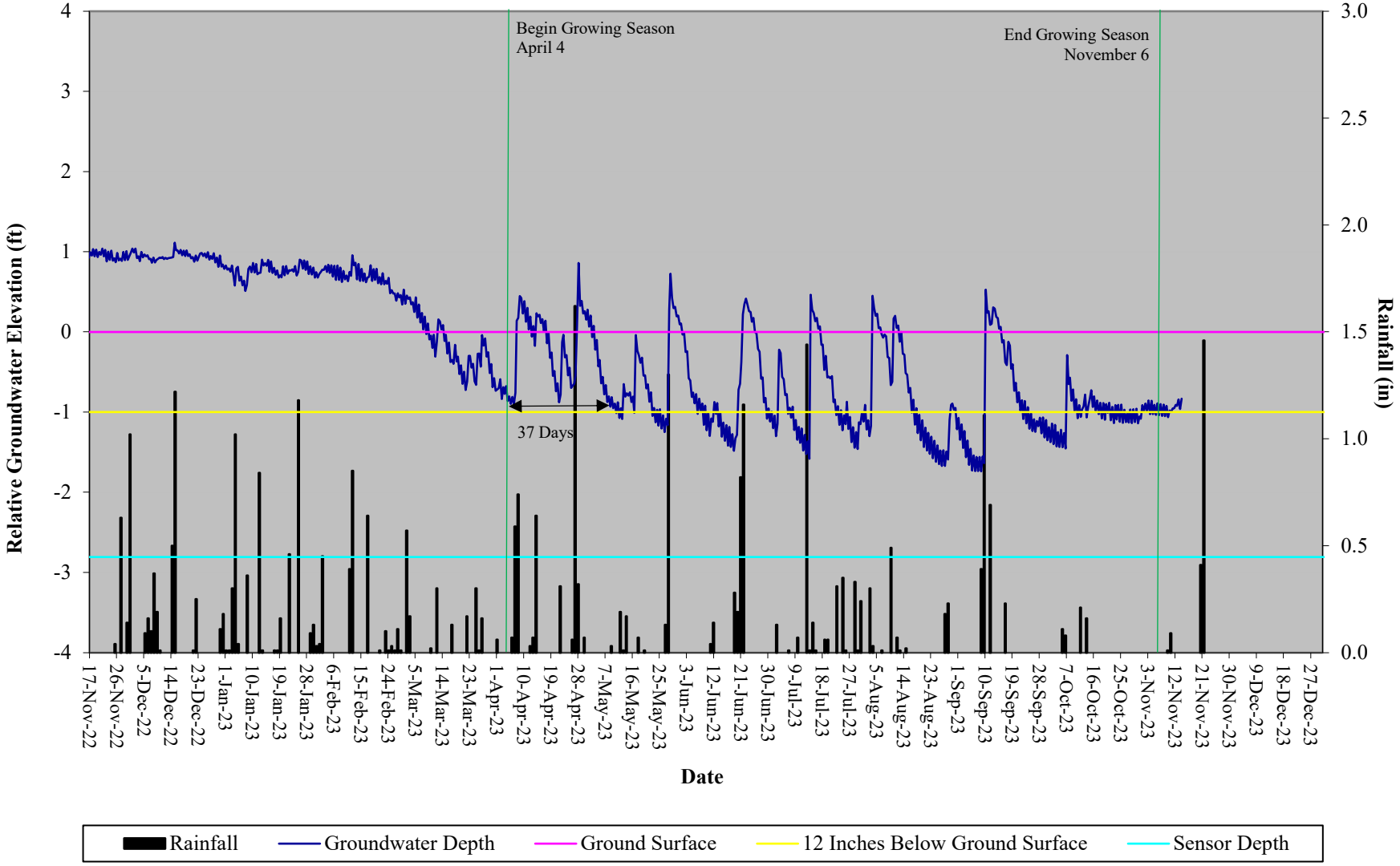
Sandy Bridge Farm Restoration Site
Hydrograph
Wetland Gauge 5



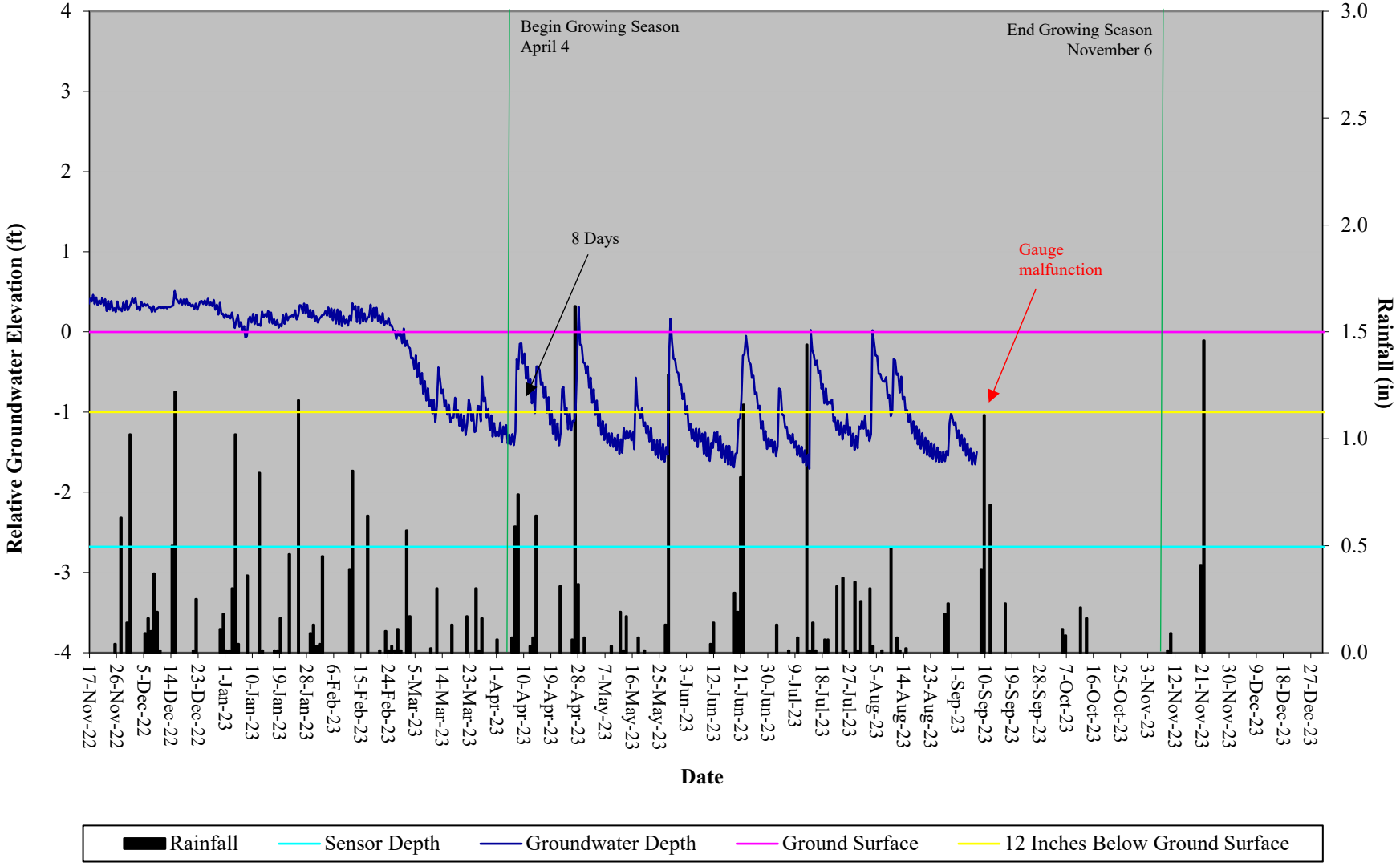

Sandy Bridge Farm Restoration Site
Hydrograph
Wetland Gauge 6
Begin Growing Season
April 4
End Growing Season
November 6
35 Days
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth


Sandy Bridge Farm Restoration Site
Hydrograph
Wetland Gauge 7
Begin Growing Season
April 4
End Growing Season
November 6
Gauge
malfunction
44 Days
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
4
3
2
1
0
-1
-2
-3
-4
3.0
2.5
2.0
1.5
1.0
0.5
0.0
17-Nov-22
26-Nov-22
5-Dec-22
14-Dec-22
23-Dec-22
1-Jan-23
10-Jan-23
19-Jan-23
28-Jan-23
6-Feb-23
15-Feb-23
24-Feb-23
5-Mar-23
14-Mar-23
23-Mar-23
1-Apr-23
10-Apr-23
19-Apr-23
28-Apr-23
7-May-23
16-May-23
25-May-23
3-Jun-23
12-Jun-23
21-Jun-23
30-Jun-23
9-Jul-23
18-Jul-23
27-Jul-23
5-Aug-23
14-Aug-23
23-Aug-23
1-Sep-23
10-Sep-23
19-Sep-23
28-Sep-23
7-Oct-23
16-Oct-23
25-Oct-23
3-Nov-23
12-Nov-23
21-Nov-23
30-Nov-23
9-Dec-23
18-Dec-23
27-Dec-23
Rainfall
Sensor Depth
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface

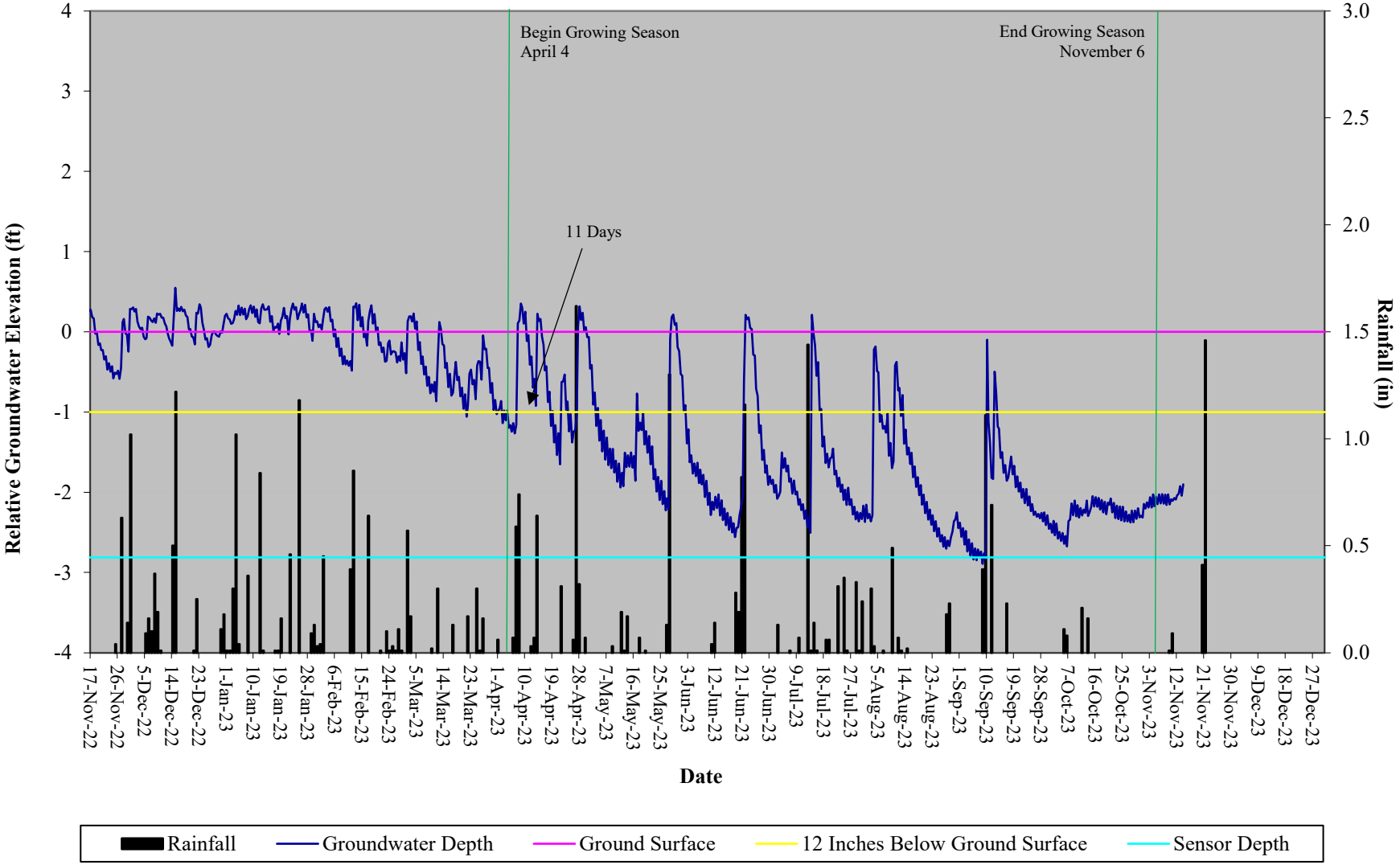
Sandy Bridge Farm Restoration Site
Hydrograph
Wetland Gauge 8



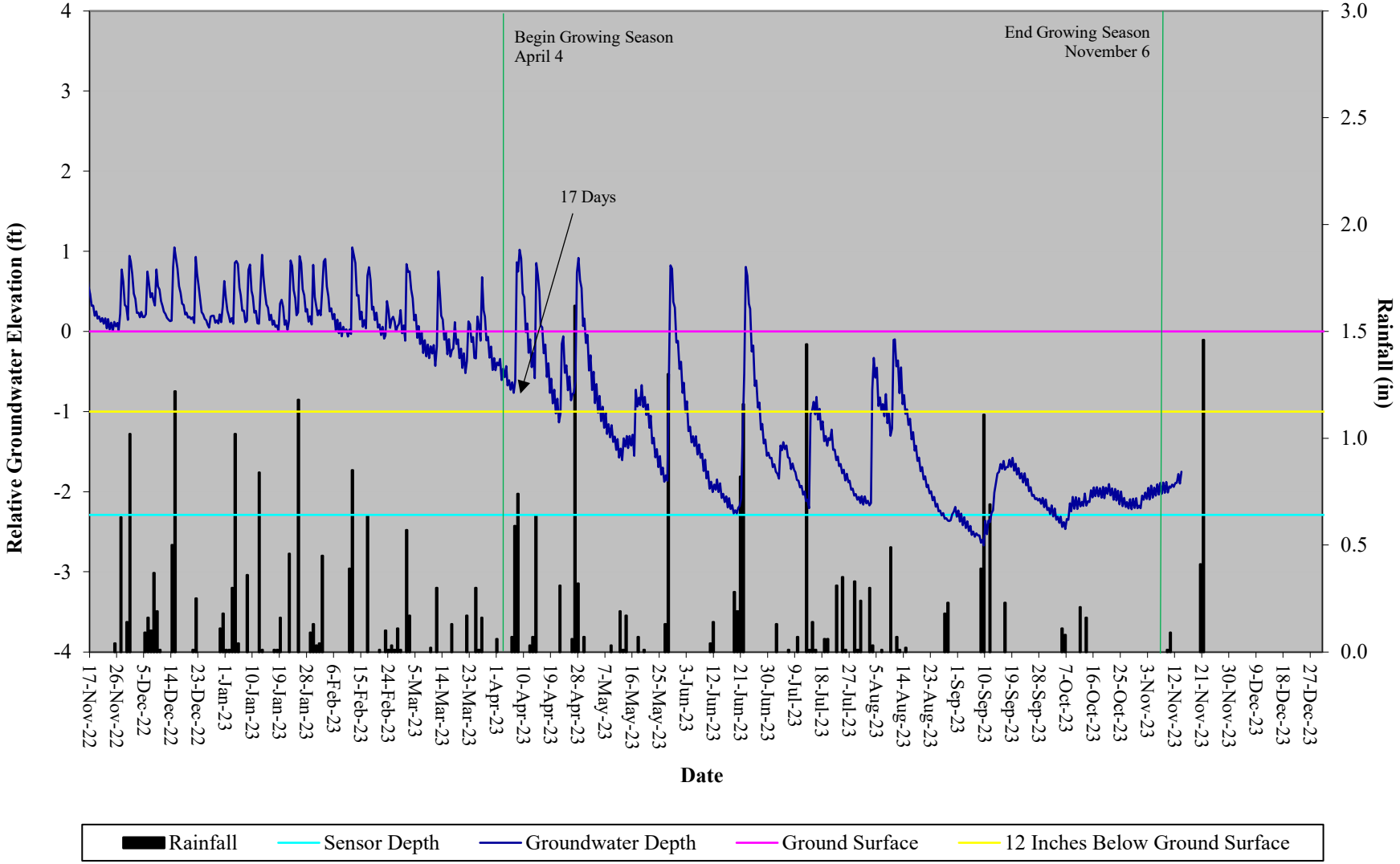
Sandy Bridge Farm Restoration Site
Hydrograph
Wetland Gauge 9



Sandy Bridge Farm Restoration Site
Hydrograph
Wetland Gauge 10



Sandy Bridge Farm Restoration Site
Hydrograph
Wetland Gauge 11



Sandy Bridge Farm Restoration Site
Hydrograph
Wetland Gauge 12

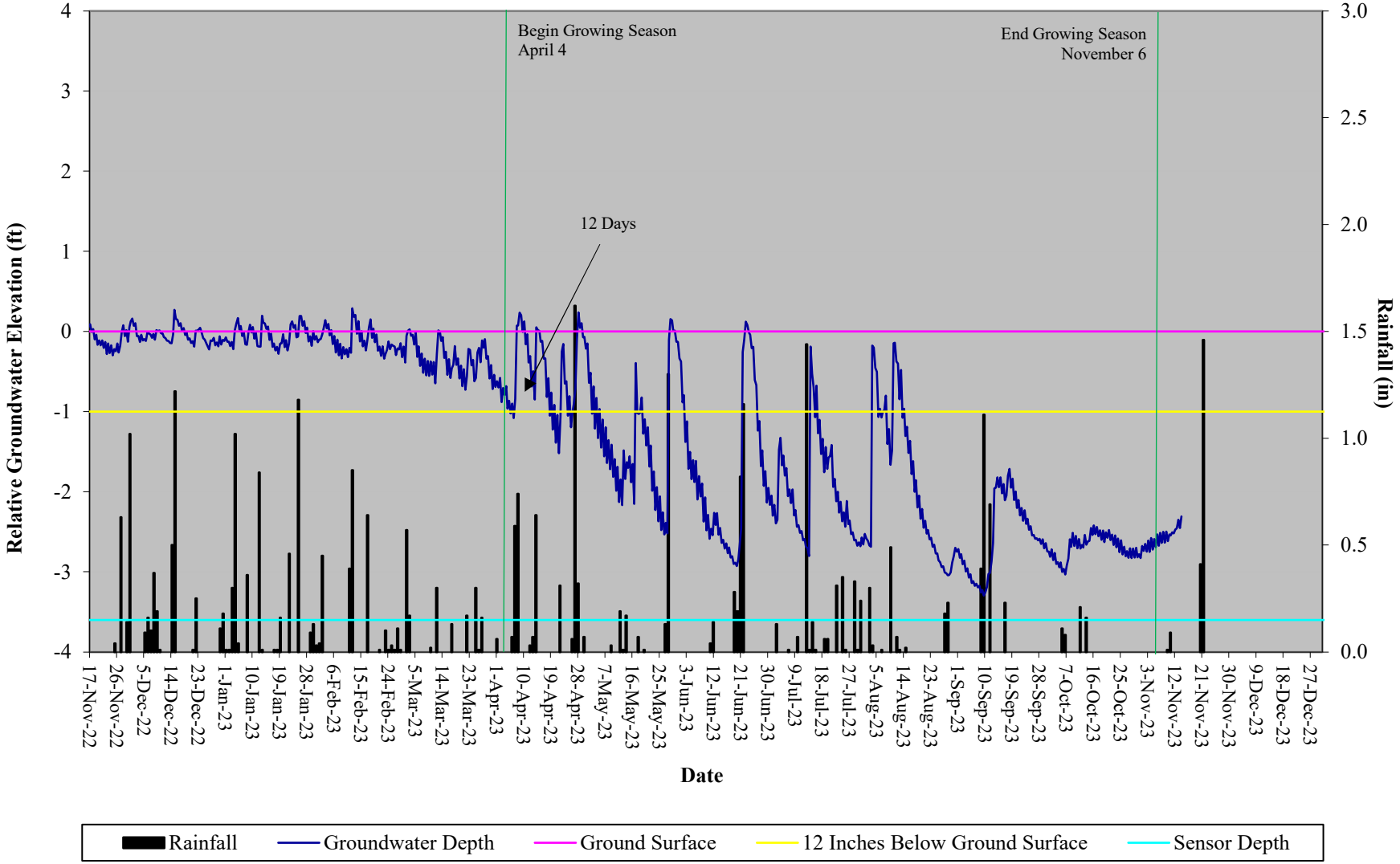


Table 11. Wetland Hydrology Criteria Attainment Sandy Bridge Farm Restoration Site, DMS Project #96920							
	Greater than 10% Continuous Saturation/Max Consecutive Days During Growing Season (Percentage)						
Gauge #	**MY-01 2017**	**MY-02 2018**	**MY-03 2019**	**MY-04 2020**	**MY-05 2021**	**MY-06 2022**	**MY-07 2023**
Gauge 1	Yes/30 (13.8%)	Yes/40 (18.4%)	Yes/46 (21.2%)	Yes/215 (99.1%)	Yes/217 (100.0%)	Yes/217 (100.0%)	Yes/217 (100.0%)
Gauge 2	No/11 (5.1%)	Yes/35 (16.1%)	Yes/32 (14.7%)	Yes/126 (58.1%)	Yes/60 (27.6%)	Yes/75 (34.6%)	No/15 (6.9%)
Gauge 3	Yes/110 (50.7%)	Yes/78 (35.9%)	Yes/162 (74.7%)	Yes/158 (72.8%)	Yes/55 (25.3%)	Yes/39 (18.0%)	Yes/71 (32.7%)
Gauge 4	Yes/47 (21.7%)	Yes/105 (48.4%)	Yes/156 (71.9%)	Yes/158 (72.8%)	Yes/82 (37.8%)	Yes/38 (17.5%)	Yes/51 (23.5%)
Gauge 5	No/11 (5.1%)	Gauge malfunction	Yes/44 (20.3%)	Yes/158 (72.8%)	Yes/84 (38.7%)	Yes/83 (38.2%)	No/11 (5.1%)
Gauge 6	Yes/30 (13.8%)	Yes/63 (29.0%)	Yes/49 (22.6%)	Yes/209 (96.3%)	Yes/96 (44.2%)	Yes/103 (47.5%)	Yes/35 (16.1%)
Gauge 7	Yes/22 (10.1%)	Yes/105 (48.4%)	Yes/162 (74.7%)	Yes/214 (98.6%)	Yes/217 (100.0%)	Yes/121 (55.8%)	Yes/44 (20.3%)
Gauge 8	Yes/29 (13.4%)	Yes/43 (19.8%)	Yes/39 (18.0%)	Yes/209 (96.3%)	Yes/96 (44.2%)	Yes/121 (55.8%)	Yes/37 (17.1%)
Gauge 9	No/15 (6.9%)	Yes/87 (40.1%)	Yes/40 (18.4%)	Yes/197 (90.8%)	Yes/95 (43.8%)	Yes/113 (52.1%)	No/8 (3.7%)
Gauge 10*		No/8 (3.7%)	Yes/22 (10.1%)	Gauge malfunction	No/14 (6.5%)	No/11 (5.1%)	No/11 (5.1%)
Gauge 11*		No/8 (3.7%)	Yes/25 (11.5%)	Gauge malfunction	Yes/52 (24.0%)	Yes/38 (17.5%)	No/17 (7.8%)
Gauge 12*		Yes/38 (17.5%)	Yes/24 (11.1%)	Yes/217 (100%)	Yes/34 (15.7%)	Yes/38 (17.5%)	No/12 (5.5%)

*=Gauge installed March 30, 2018

APPENDIX F

Additional Data

KCI ASSOCIATES OF NORTH CAROLINA, PA

SOIL PROFILE DESCRIPTION

Client: KCI Associates of North Carolina, P.A. **Date:** September 7, 2023

Project: Sandy Bridge **Project #:** 96920

County: Rutherford **State:** North Carolina

City/Town Rutherfordton **Site/Lot:** GW-2

Soil Series: Chewacla Loam

Soil Classification: Fine-loamy, mixed, active, thermic Fluvaquentic Dystrudepts

AWT: >36" **SHWT:** 0" **Slope:** 0-1% **Aspect:** Concave

Elevation: ~870' **Drainage:** Somewhat poorly drained **Permeability** Moderate

Vegetation: Planted riparian wetland restoration site

Borings terminated at 36 **Inches**

HORIZON	DEPTH (IN)	MATRIX	MOTTLES	PERCENTAGE	LOCATION	TEXTURE	STRUCTURE	NOTES
	0-8	10YR 4/2	5YR 4/6	5	M, PL	cL	2msbk	
	8-12	10YR 4/3	5YR 4/6	10	M, PL	scL	2msbk	
	12-14	10YR 4/3	5YR 4/6	20	M, PL	cL	3msbk	
	14-24	5YR 4/4	10YR 4/2	10	M	c	3msbk	
	24-30	10YR 5/4				s	single grain	coarse sand, saturated
	30-36+	10YR 4/2	5YR 4/6	20	M	sc	massive	saturated

COMMENTS:

DESCRIBED BY: Tommy Seelinger DATE: 9/7/2023

KCI ASSOCIATES OF NORTH CAROLINA, PA

SOIL PROFILE DESCRIPTION

Client: KCI Associates of North Carolina, P.A. **Date:** September 7, 2023

Project: Sandy Bridge **Project #:** 96920

County: Rutherford **State:** North Carolina

City/Town Rutherfordton **Site/Lot:** GW-10

Soil Series: Chewacla Loam

Soil Classification: Fine-loamy, mixed, active, thermic Fluvaquentic Dystrudepts

AWT: >38" **SHWT:** 0" **Slope:** 0-1% **Aspect:** Concave

Elevation: ~870' **Drainage:** Somewhat poorly drained **Permeability** Moderate

Vegetation: Planted riparian wetland restoration site

Borings terminated at 38 **Inches**

HORIZON	DEPTH (IN)	MATRIX	MOTTLES	PERCENTAGE	LOCATION	TEXTURE	STRUCTURE	NOTES
	0-2	10YR 3/2				cL	2msbk	
	2-7	10YR 4/4				cL	2msbk	
	7-10	10YR 4/2	5YR 3/4	2	PL	cL	1msbk	
	10-15	10YR 4/2	5YR 3/4	10	PL, M	cL	1msbk	Mn masses
	15-25	10YR 4/2	5YR 4/6	20	M	scL	1msbk	veins of fine sand
	25-36	5YR4/4		50		c	3msbk	saturated
		10YR 4/3		50				
	36-38+	10YR 4/3	5YR 4/4	40		sc	3msbk	saturated

COMMENTS:

DESCRIBED BY: Tommy Seelinger DATE: 9/7/2023

KCI ASSOCIATES OF NORTH CAROLINA, PA

SOIL PROFILE DESCRIPTION

Client: KCI Associates of North Carolina, P.A. **Date:** September 7, 2023

Project: Sandy Bridge **Project #:** 96920

County: Rutherford **State:** North Carolina

City/Town Rutherfordton **Site/Lot:** GW-11

Soil Series: Chewacla Loam

Soil Classification: Fine-loamy, mixed, active, thermic Fluvaquentic Dystrudepts

AWT: >30" **SHWT:** 0" **Slope:** 0-1% **Aspect:** Concave

Elevation: ~870' **Drainage:** Somewhat poorly drained **Permeability** Moderate

Vegetation: Planted riparian wetland restoration site

Borings terminated at 30 **Inches**

HORIZON	DEPTH (IN)	MATRIX	MOTTLES	PERCENTAGE	LOCATION	TEXTURE	STRUCTURE	NOTES
	0-5	5YR 4/4	10YR 4/3	5	M	cL	3msbk	
	5-9	10YR 4/3	5YR 4/4	10	M	sc	3msbk	
	9-14	10YR 4/2	5YR 4/4	10	M	sc	2msbk	
			10YR 6/6	10	M			
	14-28	10YR 4/2	5YR 4/4	5	M	Ls	1fsbk	some gravel, appears to be the old stream bed
			10YR 6/6	40	M			
	28-30+	10YR 4/2	5YR 4/4	5	M	s	massive	some gravel
			10YR 6/6	5	M			

COMMENTS:

DESCRIBED BY: Tommy Seelinger DATE: 9/7/2023

KCI
ISO 9001:2015 CERTIFIED
ENGINEERS • PLANNERS • SCIENTISTS • CONSTRUCTION MANAGERS
4505 Falls of Neuse Rd., Suite 400 • Raleigh, NC 27609 • Phone 919-783-9214 • Fax 919-783-9266

May 26, 2023

US Army Corps of Engineers
Regulatory Division
Raleigh Regulatory Field Office
3331 Heritage Trade Drive, Suite 105
Wake Forest, NC 27587
(919) 562-0421

Attention: Mr. Todd Tugwell, Chief, Mitigation Branch
Subject: Sandy Bridge Restoration Site, Outside of Easement Grading Work
USACE Action ID: 201500827 DWR #: 15-0414

Dear Mr. Tugwell:

The Sandy Bridge Restoration Site is a DMS full delivery site in Monitoring Year 07. This site has had repeated beaver colonization throughout the monitoring period. KCI has contracted a beaver removal company each time beavers are detected on site. During this period over 50 beavers have been removed from the site and many dams have been removed. Even with these significant efforts the persistent beaver activity routinely causes flooding outside of the conservation easement and in the landowner's pastures. This has been a significant problem for the landowner who is not able to use adjacent pastures when flooded. The landowner has expressed frustration and is worried about continued beaver-related hydrologic trespass after regulatory closeout of the site.

KCI has been discussing this issue with the landowner and potential strategies that could reduce the flooding outside of the easement caused by the beaver dams. While continuing beaver removal efforts is one potential solution, this would be a long-term cost for the landowner and given the heavy beaver presence, does not seem like a realistic option to continue in perpetuity. Another more robust and potentially longer-term solution would be to create a series of berms to keep surface water in the easement. This would involve building a berm along the western boundary of the site, outside of the easement. The berm would be approximately 2' in height and on the pasture side of the berm a shallow swale would be constructed so that surface water would flow south towards Cathey's Creek, where there are existing drainage features.

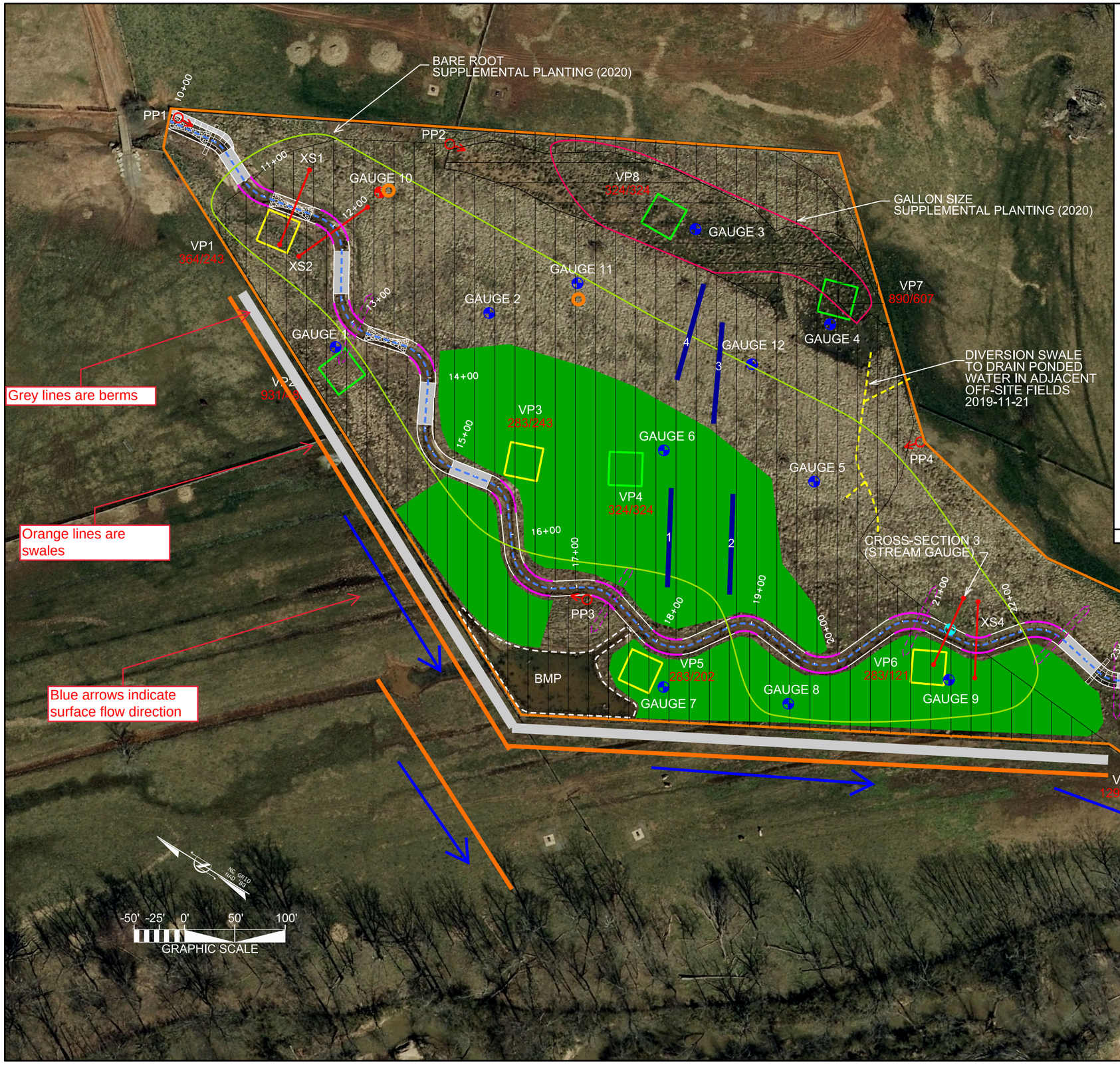
This strategy maintains site hydrology and mitigates the long-term beaver impacts to land adjacent to the site. KCI is planning to do this grading work later this summer (2023). While all this work will occur outside

of the easement, KCI feels that being transparent about this work is in the best interest of the site and the closeout process which will occur after this current monitoring year.

Attached to this memo is a figure of the site depicting this plan and photos of the site depicting the flooding that occurred this past winter when beaver dams were present and beaver removal was ongoing. If the IRT has any comments or would like to discuss this plan, please reach out to the project manager Adam Spiller at any time.

Sincerely,

Adam Spiller
KCI Technologies Inc.
Project Manager



LEGEND:

VEG PLOT ACHIEVING DENSITY CRITERION	
VEG PLOT BELOW DENSITY CRITERION	
*VEG PLOT TOTAL / PLANTED STEM DENSITY	567/401
WETLAND GAUGE ACHIEVING HYDRO. CRITERION	
WETLAND GAUGE BELOW HYDRO. CRITERION	
PHOTO POINT	
CROSS-SECTION	
CONSERVATION EASEMENT	
STREAM RESTORATION	
BEAVER DAMS	
WETLAND REESTABLISHMENT	
WETLAND REHABILITATION	
STEP POOL	
RIFFLE GRADE CONTROL	
RIFFLE ENHANCEMENT	
STREAM AGGRADATION	
LIVE STAKE SUPPLEMENTAL PLANTING	
VEGETATION TRANSECTS	
SOIL BORINGS	

*VEG DATA FROM MY05

IMAGE SOURCE: GOOGLE EARTH 2019

REVISIONS

DATE	DESCRIPTION	STAL

NCDEQ DIVISION OF MITIGATION SERVICES

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4505 FALLS OF NEUSE RD, SUITE 400
RALEIGH, NORTH CAROLINA 27609

SANDY BRIDGE FARM
STREAM AND RIPARIAN WETLAND SITE

DMS PROJECT #96920
RUTHERFORD COUNTY, NORTH CAROLINA
MONITORING YEAR 06

DATE: NOV 2022
SCALE: GRAPHIC

CURRENT CONDITION PLAN VIEW