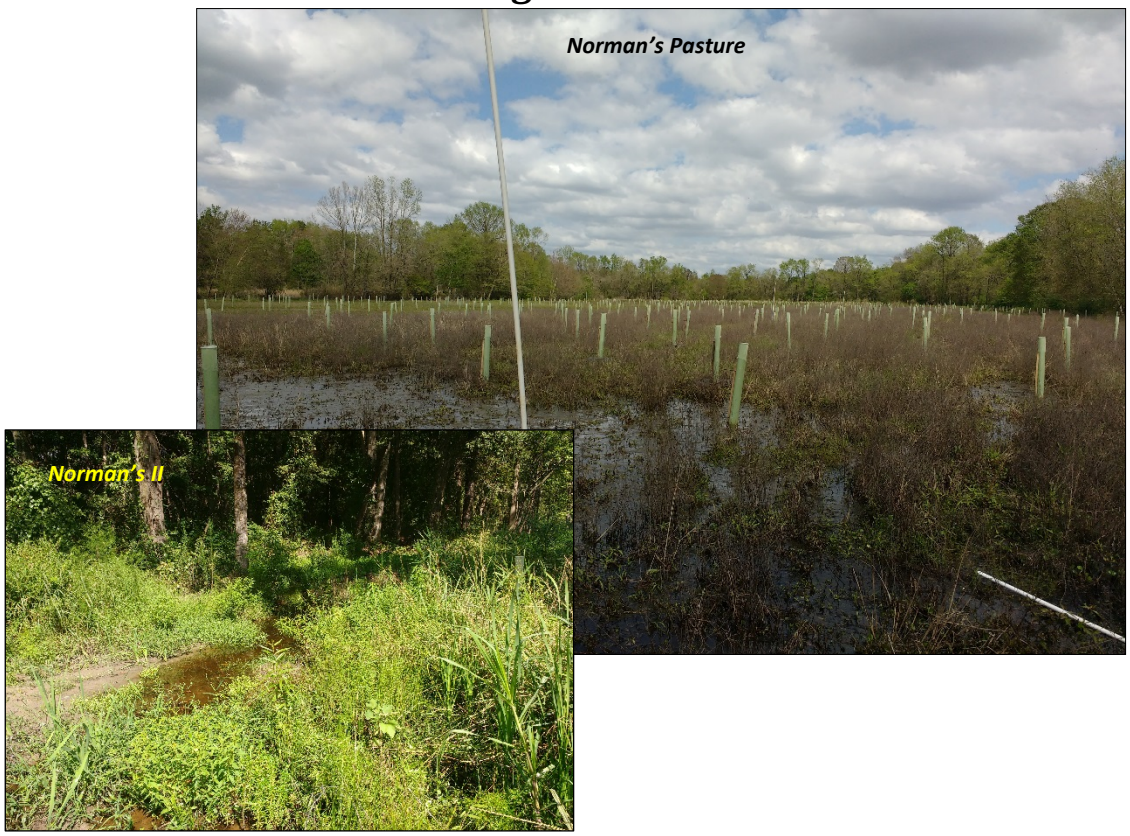
Monitoring Report

Norman's Pasture Restoration Site
DMS Contract 005010
DMS Project Number 95717

Norman's Pasture II Restoration Site
DMS Contract 5787
DMS Project Number 96310

Monitoring Year 02



Construction Completed: Feb 2016
Data Collection: August 2017
Submitted: January 2018

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

MEMORANDUM

Date: January 22, 2018
To: Jeff Schaffer, DMS Project Manager
From: Tim Morris, Project Manager
KCI Associates of North Carolina, PA
Subject: Norman's Pasture/Norman's II Restoration Sites
Year 2 Monitoring Report Comments
Cape Fear River Basin CU 03030006
Sampson County, North Carolina
DMS IMS #s 95717 & 96310

Please find below our responses in italics to the Year 2 Monitoring Report comments from NCDMS received on January 19, 2018, for the Norman's Pasture/Norman's II Restoration Sites.

1. The digital data and drawings have been reviewed. During the review, DMS received a pop up warning that the spatial reference is missing for the 01_Normans CCPV (MY02).dgn Group, 02_Normans CCPV (MY02).dgn Group, 99_Norm_BA.dgn Group and 99_Norm_BS.dgn Group layers. In addition, KCI did not submit all the required digital data files and drawings. Specifically, please submit all required GIS shapefiles for the CCPV as required by contract.
KCI Response: These files have been added to the digital data submission.

2. Section 2.2, third paragraph: Report states that gauges NPII6 and NPII8 are the only two gauges that did not meet the hydrologic success of 9%. Based on the data in Table 10, these have not met in either MY 1 or MY2. Please discuss reasons for this and provide what, if any, remedial action KCI intends to take to improve hydrology in the areas of these gauges. During the April 3, 2017 Credit Release meeting, the IRT stated that future monitoring must demonstrate hydrologic improvement or credits may be withheld for Norman's Pasture II wetlands.
KCI Response: This discussion has been added to the report. KCI is planning to install a couple of additional gauges to elucidate any potential credit reduction that may be required in those areas.

3. Section 2.2, last paragraph: Report states that the stream portion of Norman's Pasture II experienced several bankfull events in 2017. Table 9 in Appendix D also shows that there were several bankfull events in 2016 (MY 1). Please state that the stream met the bankfull standard.
KCI Response: This change has been made.

4. Appendix C, Tables 6 and 8: These tables show vegetation plot (VP) 14 as meeting success with 364 stems per acre. In looking at MY 1 data, VP 14 failed to meet success based on only 283 stems per acre. Since there was no discussion in the MY 2 report of a supplemental planting effort, please explain how VP 14 was successful in MY 2 and not in MY 1.
KCI Response: During the baseline monitoring, 17 stems were reported in VP14. When the vegetation counts for MY01 were performed, 5 of these 17 stems were reported as missing (and 5 were reported as dead). When MY02 vegetation counts were performed, only one new dead stem

was reported and 2 of the missing stems were located. It is likely that these stems were not found in MY01 due to the thick tear thumb and blackberry that is present in that area. Then by MY02 they had achieved sufficient height to be noticed amidst the thick herbaceous vegetation.

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

Sincerely,

Tim Morris
Project Manager

Monitoring and Design Firm

Prepared by:

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

Project Contact: Tim Morris
Email: tim.morris@kci.com
KCI Project # 20122925/20145090

January 2018

Table of Contents

1.0 EXECUTIVE SUMMARY / PROJECT ABSTRACT

There are two separate projects included within this report. The projects are adjacent to each other, which is why the reporting structure for these projects is combined. The Norman's Pasture Restoration Site (NPRS) was completed in February 2016 and restored a total of 16.2 acres of riparian wetlands. Two on-site tributaries were also restored to integrated headwater/stream systems, but no stream mitigation credit is included in the NPRS. The NPRS is a riparian wetland system in the Cape Fear River Basin (03030006 8-digit HUC) in eastern Sampson County, North Carolina, that had been substantially modified to maximize agricultural production. The completed project will restore impacted agricultural lands to riparian wetland habitat.

The Norman's Pasture II Restoration Site (NPII) is located directly adjacent to NPRS, was also completed in February 2016, and includes a total of 10.2 acres of riparian wetland restoration and 843 linear feet of stream enhancement II. The NPII also includes 0.8 acres of existing wetland preservation. The completed NPII project will expand on the restoration efforts of the NPRS by extending restoration and protection initiatives to the headwater extents of much of the local watershed. The site will restore and protect a range of unique aquatic resources in one setting – existing riparian wetlands, a forested tributary that had lost connection with its historic floodplain, lower gradient seep-fed headwaters, and adjacent upland buffers.

The NPRS is protected by a 36.9-acre permanent conservation easement, while NPII is protected by a 16.3-acre permanent conservation easement, both held by the State of North Carolina. Both sites are located on two parcels located off of Cornwallis Road, approximately 5 miles west of Magnolia, North Carolina. The project sites are bounded by Stewarts Creek to the south, agricultural land to the north, Cornwallis Road to the east, and woodlands to the west. The sites have a long history of hydrologic modification in order to allow for farming to take place on the property.

The Cape Fear River Basin Restoration Priorities state the goals for the NPRS and NPII's 14-digit HUC are to protect and improve water quality throughout the Basin by reducing sediment and nutrient inputs into streams and rivers and to support efforts to restore local watersheds (NCDENR EEP, 2009). The project goals for NPRS and NPII are in line with the basin priorities and include the following:

- Reconnect a continuous stream and wetland headwater wetland system to Stewarts Creek.
- Expand and protect riparian habitat along Stewart's Creek.
- Buffer nutrient inputs from adjacent agricultural and grazing practices.

Additional goals for the project include:

- Increase the local hydroperiod by encouraging both surface and subsurface storage and retention.
- Restore and establish a functional and diverse stream/wetland complex.

The project goals will be addressed through the following objectives:

- Redevelop a stream/wetland complex that has previously been impacted by ditching and cattle grazing.
- Fill field ditches to restore surface flow retention and historic flow paths.
- Protect and integrate existing riparian wetlands into the project design.
- Re-forest riparian areas with native plant communities.
- Re-connect headwater seeps to the broader swamp forest community of Stewarts Creek being restored by NPRS and NPII

Project planting and construction were completed in February 2016. The NPRS involved restoration and establishment of a functional stream/wetland complex with 16.2 acres of riparian wetland restoration (15.5 acres of re-establishment and 0.7 acre of wetland rehabilitation). Select ditches across the site were modified or filled and seeps were redirected and redeveloped to retain and distribute surface flow across the site. The two project tributaries (Tributaries 1 and 2 to Stewarts Creek) were restored to integrated headwater/stream systems, but no stream mitigation credit is included in NPRS. Approximately 9.0 acres of wetland preservation is included throughout the NPRS, but for no additional credit.

The NPII aimed to restore and establish a stream/wetland complex with 10.2 acres of riparian wetland restoration (8.8 acres of re-establishment and 1.4 acres of rehabilitation). Approximately 843 linear feet of Tributary 1 to Stewarts Creek were improved with Enhancement II and reconnected to the historic floodplain. Also, approximately 0.8 acre of existing wetlands were included as preservation at NPII (no mitigation credit).

Both NPRS and NPII were constructed as designed with only a few modifications made to the design plan during construction. On NPRS, several portions of the on-site ditches were not filled and a ditch plug was not installed to allow Stewart's Creek better flood access to the site. Two extra areas were also planted as Headwater Forest Communities. On NPII, one riffle enhancement and one log drop were not installed at the very beginning of the stream reach. Several extra HDPE pipes were also added at the crossings to allow better hydraulic connectivity between the different areas of the site.

The monitoring components were installed in February and March 2016 for both sites. 22 monitoring gauges (9 on NPRS and 13 on NPII) were installed to evaluate the attainment of jurisdictional wetland hydrology for both sites. One additional monitoring gauge was installed in the stream on NPII to document the presence of surface water and record the occurrence of bankfull events. To determine the success of the planted mitigation areas, 31 permanent vegetation monitoring plots (18 on NPRS and 13 on NPII) were established according to the CVS-EEP Level 2 protocol. Ten permanent photo points have been established with a total of twelve photos to be taken annually. The site will be monitored for five to seven years or until the success criteria are achieved. Reports will be submitted to the DMS each year.

The success criteria for the sites state that the planted wetlands must meet the success criteria of a site average of 320 stems/acre after three years, 288 stems/acre after four years, 260 stems/acre after five years, and 210 stems/acre after seven years to be considered successful. The second year monitoring counted an average of 752 planted stems/acre and 1,295 total stems/acre. All 31 of the vegetation monitoring plots met the success criteria.

Wetland hydrology will be monitored with the series of 22 automatic gauges described above that record water table depth. An additional two gauges were installed outside of the credit bearing area to monitor hydrology in what could become a (non-credit bearing) wetland creation area within the easement. To meet the success criterion, the upper 12 inches of the soil profile must have continuously saturated or inundated conditions for at least 9.0% of the growing season in the Headwater Forest community and 12.0% of the growing season in the Riverine Swamp Forest community during normal weather conditions. During the site's second growing season, all of the 9 gauges at NPRS and 11 of the 13 gauges at NPII met the success criteria.

2.0 MONITORING RESULTS

2.1 Vegetation Monitoring Results

The vegetation monitoring success criterion for the planted mitigation area is a density of 320 stems/acre after the third year of monitoring and an allowance for 10% mortality in the following years for a stem density of 288 stems/acre after four years, 260 stems/acre after five years, and 210 stems/acre after seven years to be considered successful. To determine the success of the planted mitigation area, thirty-one permanent vegetation monitoring plots (10 by 10 meters) have been established in the mitigation area at a density that represents the total mitigation acreage. Eighteen of these plots are in NPRS and thirteen of these are in NPII. The second-year vegetation monitoring was based on the Level 2 CVS-EEP vegetation monitoring protocol. The site's average density for this monitoring period was 752 planted stems/acre. All 31 plots exceeded 320 planted stems/acre. Including volunteers, the site averaged 1,295 total stems/acre.

The vegetation monitoring was completed on August 11, 2017.

2.2 Hydrology Monitoring Results

Twenty-two groundwater monitoring gauges were installed in the wetland mitigation areas to measure wetland hydrology. Nine of these gauges are in Norman's Pasture (NP) and thirteen are in Norman's Pasture II (NPII). In addition to this, two other gauges were installed outside of the credit bearing area to monitor hydrology in what could become a (non-credit bearing) wetland creation area within the easement. The soil survey for Sampson County estimates that the growing season begins February 28 and ends November 21 (267 days). The success criteria for the site states that the water table of the restored wetlands must be within 12" of the soils surface continuously for at least 9% (24 days) of the growing season for headwater forest systems and 12% (32 days) for riverine swamp forest systems during normal weather conditions. A "normal" year is based on NRCS climatological data for Sampson County, and using the 30th to 70th percentile thresholds as the range of normal, as documented in the USACE Technical Report "Accessing and Using Meteorological Data to Evaluate Wetland Hydrology" (Sprecher and Warne, 2000).

The daily rainfall data was obtained from a local weather station in Clinton, NC; provided by the NC State Climate Office. For the 2017-year, the months of April, May, and June experienced an above average rainfall, while March, August, September, and October experienced average rainfall. The months of January, February, July, and November recorded below average rainfall for the site. Overall, the area experienced average rainfall during the 2017 growing season.

During the site's second growing season, twenty of the twenty-two wells met the success criterion of having saturated soil conditions occurring within 12 inches of the ground surface for a minimum continuous period of 9% (24 days) for headwater forest systems or 12% (32 days) for riverine swamp forest systems of the 267 day growing season (February 28 to November 21) during average climatic conditions. The gauges that did not meet are Gauges NPII 6 and NPII8. These two gauges also did not meet in MY01. It is believed that these gauges have struggled to meet the success criteria because NPII 8 is located at the highest elevation of any gauge on the site and NPII 6 is located near the edge of the restored area. KCI is planning to install a couple additional gauges around these gauges to clarify the extent of any potentially non-attaining areas. Please refer to Table 10 in Appendix D.

As part of the site success criteria the stream must experience two bankfull events in separate years. The stream experienced several bankfull events in both 2016 and 2017 and has met this criteria. See Table 9 in Appendix D.

2.3 Visual Monitoring Results

A yearly visual assessment of the enhanced stream on NPII will occur every year. The second year monitoring visual assessment found the stream to be in good condition. As the photos show, there has been a high survival rate of live stakes and herbaceous streamside vegetation is thriving. One small area of erosion developed shortly after construction and was repaired before the end of the first growing season. Despite numerous large flow events, the stream has shown no additional signs of erosion since. The stream corridor is also showing signs of a higher water table, which was a goal of raising the streambed elevation. This is evidenced by more standing surface water compared to pre-construction conditions and the gauge data from the adjacent monitored wetlands.

3.0 REFERENCES

Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation, Version 4.2 (http://cvs.bio.unc.edu/methods.htm)

NCDENR, Ecosystem Enhancement Program. 2009. Cape Fear River Basin Restoration Priorities 2009. Raleigh, NC. https://ncdenr.s3.amazonaws.com/s3fs-public/PublicFolder/Work%20With/Watershed%20Planners/RBRP%20Cape%20Fear%202009.pdf

Sprecher, S. W., and Warne, A. G. (2000). "Accessing and Using Meteorological Data to Evaluate Wetland Hydrology," ERDC/EL TR-WRAP-00-1, U.S. Army Engineer Research and Development Center, Vicksburg, MS.USACE. 2003. Stream Mitigation Guidelines. USACE, NCDENR-DWQ, USEPA, NCWRC.

USACE. 2003. Stream Mitigation Guidelines. USACE, NCDENR-DWQ, USEPA, NCWRC.

United States Department of Agriculture. 1985. Soil Survey of Sampson County, North Carolina. USDA, NCDENR, SCS. https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/north_carolina/NC163/0/sampson.pdf

Appendix A

Project Vicinity Map and Background Tables

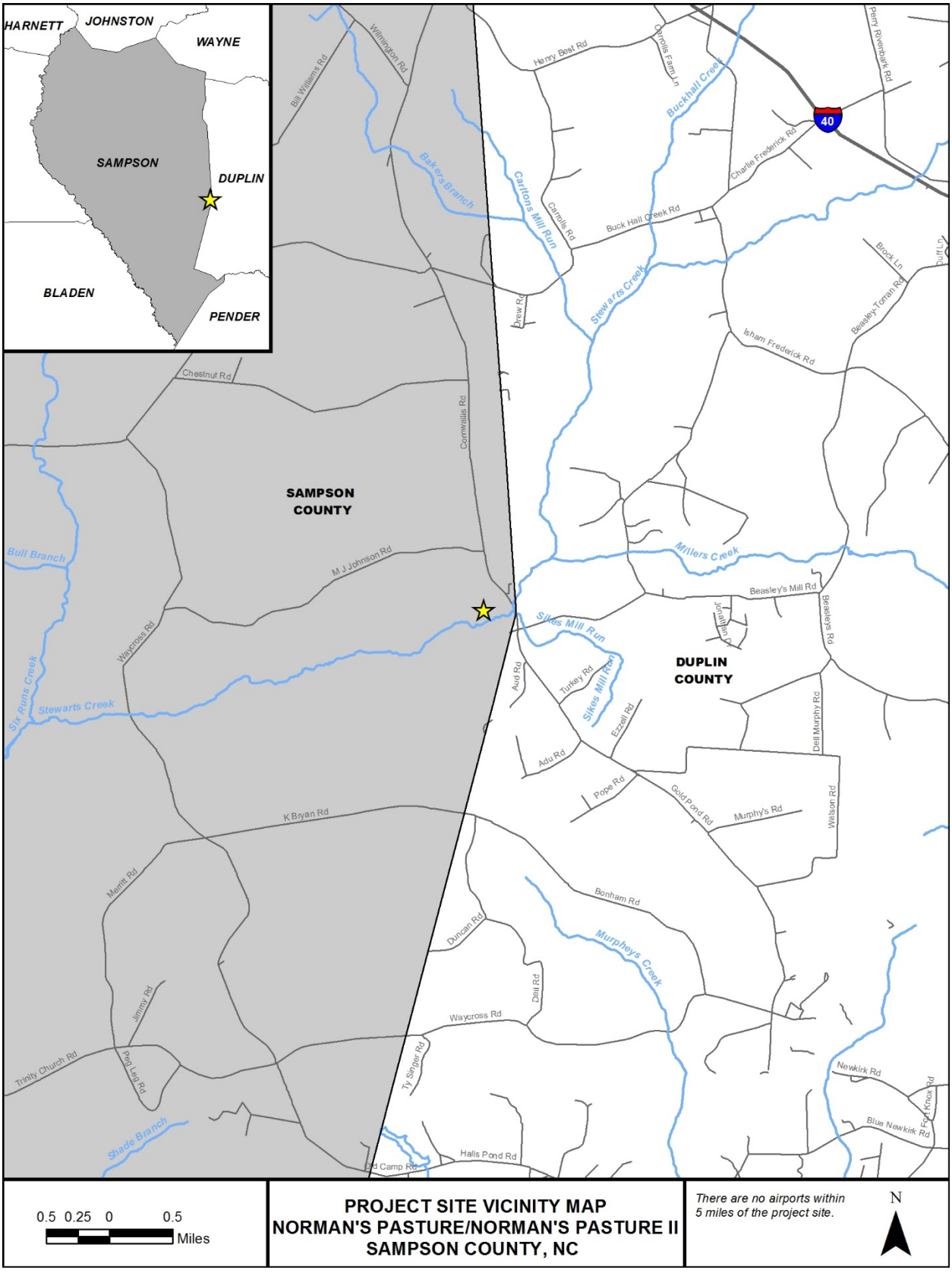

HARNETT
JOHNSTON
WAYNE
SAMPSON
DUPLIN
BLADEN
PENDER
SAMPSON COUNTY
DUPLIN COUNTY
Wilmington Rd
Bill Williams Rd
Baker's Branch
Carlton's Mill Run
Buckhall Creek
Henry Best Rd
Carrolls Farm Ln
Perry Rivenbark Rd
40
Charlie Frederick Rd
Carrolls Rd
Buck Hall Creek Rd
Stewarts Creek
Brock Ln
Beasley Toran Rd
Isham Frederick Rd
Chestnut Rd
Cornwallis Rd
Millers Creek
Beasley's Mill Rd
Jonathan Ln
Beasleys Rd
Sikes Mill Run
Sikes Mill Road
Turkey Rd
Aud Rd
Ezzell Rd
Dell Murphy Rd
Adu Rd
Pope Rd
Gold Pond Rd
Murphy's Rd
Welson Rd
Bull Branch
M J Johnson Rd
Waycross Rd
Six Runs Creek
Stewarts Creek
K Bryan Rd
Merritt Rd
Bonham Rd
Duncan Rd
Murpheys Creek
Dell Rd
Jimmy Rd
Waycross Rd
Ty Singer Rd
Trinity Church Rd
Peg Leg Rd
Newkirk Rd
Fort Knox Rd
Blue Newkirk Rd
Shade Branch
Old Camp Rd
Halls Pond Rd
0.5 0.25 0 0.5
Miles
PROJECT SITE VICINITY MAP
NORMAN'S PASTURE/NORMAN'S PASTURE II
SAMPSON COUNTY, NC
There are no airports within 5 miles of the project site.
N

Table 1a. Project Components and Mitigation Credits
Norman's Pasture Restoration Site, DMS Project #95717

Mitigation Credits

	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Length			16.2						
Credits			16.0						
TOTAL CREDITS			16.0						

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
Wetland Reestablishment				Restoration	15.5	1:1
Wetland Rehabilitation				Restoration	0.7	1.5:1
Wetland Preservation				Preservation	9.0	NA

Component Summation

Restoration Level	Stream (linear feet)	Riparian Wetlands (Acres)		Non-Riparian Wetlands (Acres)	Buffer (square feet)	Upland (Acres)
		Riverine	Non-Riverine			
Restoration		16.2				
Enhancement						
Enhancement I						
Enhancement II						
Creation						
Preservation						
High Quality Preservation						
TOTAL CREDITS		**16.0**				

Table 1b. Project Components and Mitigation Credits
Norman's II Restoration Site, DMS Project #96310

Mitigation Credits

	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Length		843	10.2						
Credits		337	9.7						
TOTAL CREDITS	337		9.7						

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
Tributary 1	10+00 – 18+43	843		Enhancement II	843	2.5:1
Wetland Reestablishment				Restoration	8.8	1:1
Wetland Rehabilitation				Restoration	1.4	1.5:1
Wetland Preservation				Preservation	0.8	NA

Component Summation

Restoration Level	Stream (linear feet)	Riparian Wetlands (Acres)		Non-Riparian Wetlands (Acres)	Buffer (square feet)	Upland (Acres)
		Riverine	Non-Riverine			
Restoration			9.7			
Enhancement						
Enhancement I						
Enhancement II	337					
Creation						
Preservation						
High Quality Preservation						
TOTAL CREDITS	**337**		**9.7**			

Table 2. Project Activity & Reporting History Norman's Pasture and Norman's II Restoration Sites		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Mitigation Plan		Nov 2014
Final Design - Construction Plans		Jan 2015
Construction		Jan 2016
Planting		Feb 2016
Baseline Monitoring/Report	April 2016	April 2016
Vegetation Monitoring	March 31, 2016	
Photo Points	April 15, 2016	
Year 1 Monitoring	Nov 2016	Dec 2016
Vegetation Monitoring	Nov 1, 2016	
Photo Points	Aug 16, 2016	
Gauge Downloads	Nov 22, 2016	
Year 2 Monitoring	Nov 2017	Jan 2018
Vegetation Monitoring	Aug 11, 2017	
Photo Points	Nov 30, 2017	
Gauge Downloads	Nov 30, 2017	

Table 3. Project Contacts **Norman's Pasture and Norman's II Restoration Sites**	
Design Firm	KCI Associates of North Carolina, PC 4505 Falls of Neuse Rd. Suite 400 Raleigh, NC 27609 Contact: Mr. Tim Morris Phone: (919) 278-2512 Fax: (919) 783-9266
Construction Contractor	KCI Environmental Technologies and Construction 4505 Falls of Neuse Rd. Suite 400 Raleigh, NC 27609 Contact: Mr. Tim Morris Phone: (919) 278-2512
Planting Contractor	Conservation Services Inc. 1620 N. Delphine Ave. Waynesboro, VA 22980 Contact: Mr. David Coleman Phone: (540) 941-0067
Monitoring Performers	
MY-00 – MY-02	KCI Associates of North Carolina, PC 4505 Falls of Neuse Rd. Suite 400 Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 278-2514 Fax: (919) 783-9266

Table 4a. Project Information, Norman's Pasture Restoration Site, DMS Project #95717				
Project Name	Norman's Pasture Restoration Site			
County	Sampson County			
Project Area (acres)	36.92 acres			
Project Coordinates (lat. and long.)	34.904893 N , -78.151460 W			
Project Watershed Summary Information				
Physiographic Province	Coastal Plain			
River Basin	Cape Fear			
USGS Hydrologic Unit 8-digit	03030006	**USGS Hydrologic Unit 14-digit**	03030006110040	
DWQ Sub-basin	03-06-19			
Project Drainage Area (acres)	186 acres			
Project Drainage Area Percentage of Impervious Area	1%			
CGIA Land Use Classification	Managed Herbaceous Cover 42% (77.3 ac), Cultivated 24% (44.3 ac), Bottomland Forest/ Hardwood Swamps 17% (31.0 ac), Southern Yellow Pine 10% (19.5 ac), Mixed Hardwoods/Conifers 5% (9.2 ac), and Evergreen Shrubland 2% (4.2 ac)			
Reach Summery Information (Post Restoration)				
Parameters	**T1**		**T2**	
Length of reach (linear feet)	1,585		1,612	
Valley classification	Valley Type X		Valley Type X	
Drainage area (acres)	112 acres		36 acres	
NCDWQ Water Quality Classification	Project Reach Not Classified; Receiving water = Stewart's Creek (C; SW)		Project Reach Not Classified; Receiving water = Stewart's Creek (C; SW)	
Morphological Description (stream type)	Portions ditched channel; other C5		Portions headwater stream; others ditched channel	
Evolutionary trend	Channelized		Channelized	
Mapped Soil Series	Chipley Johnston; Torhunta		Bibb and Johnston; Johnston; Lumbee	
Drainage class	Somewhat poorly drained, very poorly drained, very poorly drained		Poorly drained; very poorly drained; poorly drained	
Soil Hydric status	Drained hydric		Drained hydric	
Slope	0-2%		0-2%	
FEMA classification	Zone AE		Zone AE	
Native vegetation community	Pasture, Headwater Forest		Pasture, Riverine Swamp Forest	
Percent composition of exotic invasive vegetation	<5%		<5%	
Wetland Summary Information (Post Restoration)				
Parameters	**Area 1**	**Area 4**	**Area 9**	**Area 10**
Size of Wetland (acres)	1.99 acres	5.20 acres	2.19 acres	0.02 acres
Wetland Type	Riparian	Riparian	Riparian	Riparian
Mapped Soil Series	Bibb and Johnston	Lumbee	Bibb and Johnston	Bibb and Johnston
Drainage class	Poorly or very poorly drained	Poorly drained	Poorly or very poorly drained	Poorly or very poorly drained
Soil Hydric Status	Drained hydric	Drained hydric	Drained hydric	Drained hydric
Source of Hydrology	Seepage/ Precipitation	Seepage/ Precipitation	Seepage/ Precipitation	Seepage/ Precipitation
Hydrologic Impairment	Ditching and Crops	Ditching and Crops	Ditching and Crops	Ditching and Crops
Native vegetation community	Crops, Pasture, Wetland	Crops, Pasture, Forested Wetland	Crops, Pasture, Forested Wetland	Crops, Pasture
Percent composition of exotic invasive vegetation	<5%	<5%	<5%	<5%

Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States – Section 404	Yes	Yes	Jurisdictional Determination
Waters of the United States – Section 401	Yes	Yes	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	Yes	Yes	No-Rise Certification/FEMA Floodplain Checklist
Essential Fisheries Habitat	No	N/A	N/A

Table 4b. Project Information, Norman's II Restoration Site, DMS Project #96310			
Project Name	Norman's II Restoration Site		
County	Sampson County		
Project Area (acres)	16.3 acres		
Project Coordinates (lat. and long.)	34.906839 N , -78.151797 W		
Project Watershed Summary Information			
Physiographic Province	Coastal Plain		
River Basin	Cape Fear		
USGS Hydrologic Unit 8-digit	03030006	**USGS Hydrologic Unit 14-digit**	03030006110040
DWQ Sub-basin	03-06-19		
Project Drainage Area (acres)	139 acres		
Project Drainage Area Percentage of Impervious Area	1%		
CGIA Land Use Classification	Cultivated 32% (44.3 ac), Managed Herbaceous Cover 31% (42.9 ac), Bottomland Forest/Hardwood Swamps 14% (19.5 ac), Southern Yellow Pine 14% (19.5 ac), Mixed Hardwoods/Conifers 6% (9.0 ac), and Evergreen Shrubland 3% (4.2 ac)		

Reach Summery Information (Post Restoration)	
Parameters	**T1**
Length of reach (linear feet)	843
Valley classification	Valley Type X
Drainage area (acres)	112 acres
NCDWQ Water Quality Classification	Project Reach Not Classified; Receiving water = Stewart's Creek (C; SW)
Morphological Description (stream type)	Modified E5
Evolutionary trend	Stage III
Mapped Soil Series	Johnston
Drainage class	Very poorly drained
Soil Hydric status	Drained hydric
Slope	0-1%
FEMA classification	Zone AE & Zone X
Native vegetation community	Headwater Forest
Percent composition of exotic invasive vegetation	<5%

Wetland Summary Information (Post Restoration)					
Parameters	**Area 6**	**Area 7**	**Area 8**	**Area 9**	**Area 11**
Size of Wetland (acres)	0.09 acre	0.17 acre	0.37 acre	0.02 acre	0.08 acre
Wetland Type	Riparian	Riparian	Pond and Riparian	Riparian	Riparian
Mapped Soil Series	Bibb and Johnston; Lumbee	Johnston loam	Lynn Haven	Bibb and Johnston	Torhunta Variant
Drainage class	Poorly or very poorly drained	Very poorly drained	Poorly or very poorly drained	Poorly or very poorly drained	Very poorly drained
Soil Hydric Status	Drained Hydric	Drained Hydric	Drained Hydric	Drained Hydric	Drained Hydric
Source of Hydrology	Seepage/ Precipitation	Seepage / Precipitation	Seepage/ Precipitation	Seepage / Precipitation	Seepage / Precipitation
Hydrologic Impairment	Ditching and Crops	Ditching and Crops	Ditching and Crops	Ditching and Crops	Ditching
Native vegetation community	Crops, Pasture, Wetland	Crops, Pasture, Wetland	Crops, Pasture	Crops, Pasture, Forested Wetland	Forested Wetland

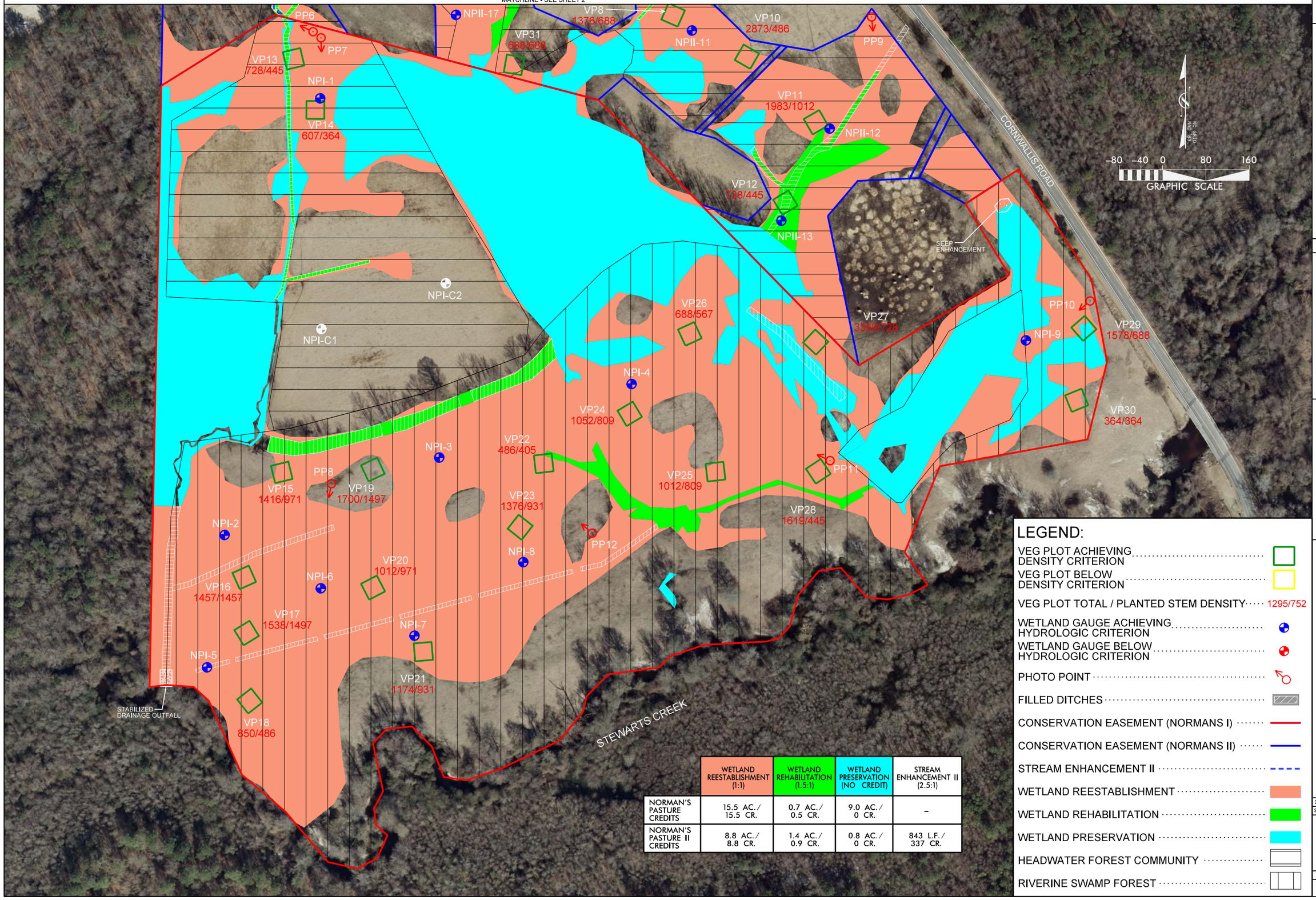
Percent composition of exotic invasive vegetation	0%	0%	0%	0%	

Project Information continued - Norman's II Restoration Site Restoration Site			
Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States – Section 404	Yes	Yes	Jurisdictional Determination
Waters of the United States – Section 401	Yes	Yes	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	Yes	Yes	FEMA Floodplain Checklist
Essential Fisheries Habitat	No	N/A	N/A

Appendix B

Visual Assessment Data

MATCHLINE - SEE SHEET 2



	WETLAND REESTABLISHMENT (1:1)	WETLAND REHABILITATION (1.5:1)	WETLAND PRESERVATION (NO CREDIT)	STREAM ENHANCEMENT II (2.5:1)
NORMAN'S PASTURE CREDITS	15.5 AC./ 15.5 CR.	0.7 AC./ 0.5 CR.	9.0 AC./ 0 CR.	–
NORMAN'S PASTURE II CREDITS	8.8 AC./ 8.8 CR.	1.4 AC./ 0.9 CR.	0.8 AC./ 0 CR.	843 L.F./ 337 CR.

LEGEND:

- VEG PLOT ACHIEVING DENSITY CRITERION
- VEG PLOT BELOW DENSITY CRITERION
- VEG PLOT TOTAL / PLANTED STEM DENSITY ····· 1295/752
- WETLAND GAUGE ACHIEVING HYDROLOGIC CRITERION
- WETLAND GAUGE BELOW HYDROLOGIC CRITERION
- PHOTO POINT
- FILLED DITCHES
- CONSERVATION EASEMENT (NORMANS I)
- CONSERVATION EASEMENT (NORMANS II)
- STREAM ENHANCEMENT II
- WETLAND REESTABLISHMENT
- WETLAND REHABILITATION
- WETLAND PRESERVATION
- HEADWATER FOREST COMMUNITY
- RIVERINE SWAMP FOREST

DATE

REVISIONS

NCDEQ DIVISION OF MITIGATION SERVICES

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4505 FALLS OF NEUSE ROAD
RALEIGH, NORTH CAROLINA 27609

NORMAN'S PASTURE & NORMAN'S PASTURE II RESTORATION SITES

SAMPSON COUNTY, NORTH CAROLINA

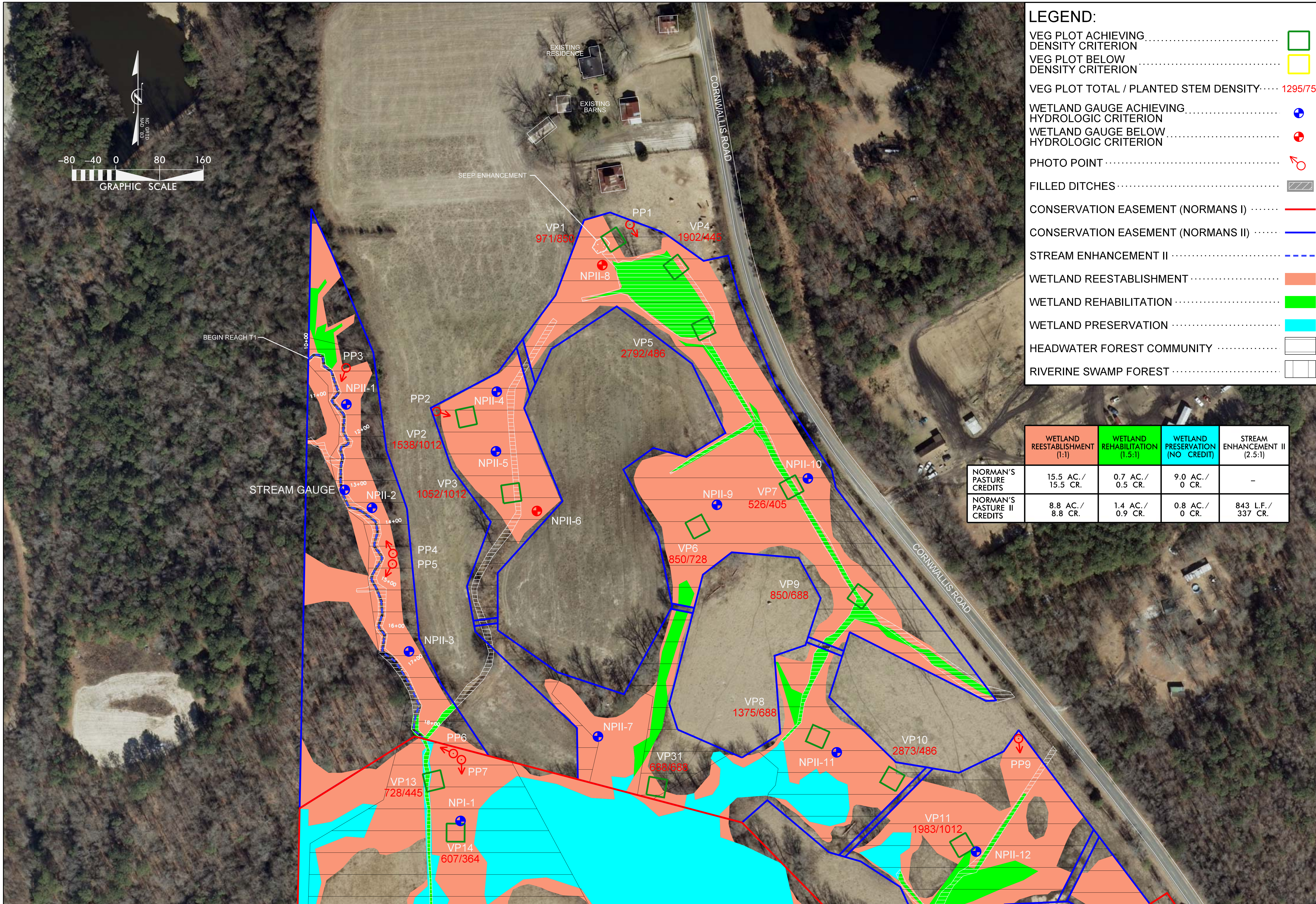
MONITORING YEAR 02

DATE: DEC 2017

SCALE: GRAPHIC

CURRENT CONDITION PLAN VIEW

SHEET 1 OF 2



	WETLAND REESTABLISHMENT (1:1)	WETLAND REHABILITATION (1.5:1)	WETLAND PRESERVATION (NO CREDIT)	STREAM ENHANCEMENT II (2.5:1)
NORMAN'S PASTURE CREDITS	15.5 AC./ 15.5 CR.	0.7 AC./ 0.5 CR.	9.0 AC./ 0 CR.	–
NORMAN'S PASTURE II CREDITS	8.8 AC./ 8.8 CR.	1.4 AC./ 0.9 CR.	0.8 AC./ 0 CR.	843 L.F./ 337 CR.

REVISIONS | DATE

NCDEQ DIVISION OF MITIGATION SERVICES

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NORMAN'S PASTURE & NORMAN'S PASTURE II RESTORATION SITES
SAMPSON COUNTY, NORTH CAROLINA
MONITORING YEAR 02

DATE: DEC 2017
SCALE: GRAPHIC

CURRENT CONDITION PLAN VIEW

SHEET 2 OF 2

Table 5a. Vegetation Condition Assessment
Norman's Pasture Restoration Site, DMS Project #95717

Planted Acreage 36.92 **Easement Acreage 36.92**

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 acre	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 acre	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 acre	Pattern and Color	0	0.00	0.0%
			Cumulative Total	0	0.00	0.0%
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1,000 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%

Table 5b. Vegetation Condition Assessment
Norman's Pasture II Restoration Site, DMS Project #96310

Planted Acreage 16.3 **Easement Acreage 16.3**

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 acre	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 acre	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 acre	Pattern and Color	0	0.00	0.0%
			Cumulative Total	0	0.00	0.0%
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1,000 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%

Vegetation Monitoring Plot Photos

Plot 1 – MY-02 – 8/11/17

Plot 2 – MY-02 – 8/11/17

Plot 3 – MY-02 – 8/11/17

Plot 4 – MY-02 – 8/11/17

Plot 5 – MY-02 – 8/11/17

Plot 6 – MY-02 – 8/11/17

Plot 7 – MY-02 – 8/11/17

Plot 8 – MY-02 – 8/11/17

Plot 9 – MY-02 – 8/11/17

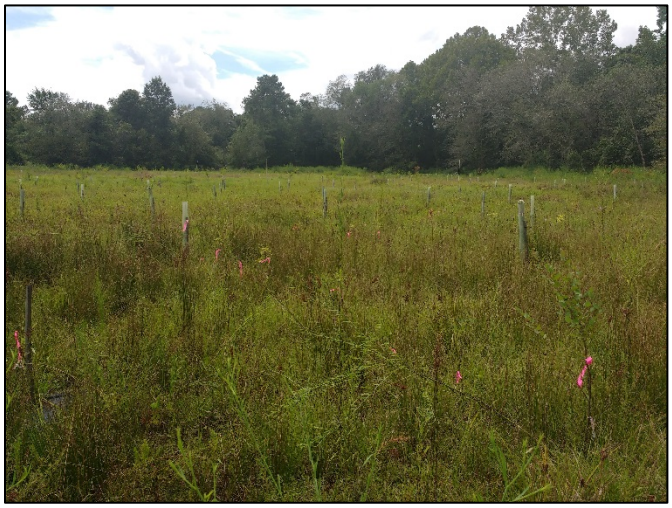
Plot 10 – MY-02 – 8/11/17

Plot 11 – MY-02 – 8/11/17

Plot 12 – MY-02 – 8/11/17

Plot 13 – MY-02 – 8/11/17

Plot 14 – MY-02 – 8/11/17



Plot 15 – MY-02 – 8/11/17

Plot 16 – MY-02 – 8/11/17

Plot 17 – MY-02 – 8/11/17

Plot 18 – MY-02 – 8/11/17

Plot 19 – MY-02 – 8/11/17

Plot 20 – MY-02 – 8/11/17

Plot 21 – MY-02 – 8/11/17

Plot 22 – MY-02 – 8/11/17

Plot 23 – MY-02 – 8/11/17

Plot 24 – MY-02 – 8/11/17

Plot 25 – MY-02 – 8/11/17

Plot 26 – MY-02 – 8/11/17

Plot 27 – MY-02 – 8/11/17

Plot 28 – MY-02 – 8/11/17

Plot 29 – MY-02 – 8/11/17

Plot 30 – MY-02 – 8/11/17

Plot 31 – MY-02 – 8/11/17

Photo Reference Points

PP01 – MY-00 – 4/15/16

PP01 – MY-02 – 11/30/17

PP02 – MY-00 – 4/15/16

PP02 – MY-02 – 11/30/17

PP03 – MY-00 – 4/15/16

PP03 – MY-02 – 11/30/17

PP04 – MY-00 – 4/15/16

PP04 – MY-02 – 11/30/17

PP05 – MY-00 – 4/15/16

PP05 – MY-02 – 11/30/17

PP06 – MY-00 – 4/15/16

PP06 – MY-02 – 11/30/17

PP07 – MY-00 – 4/15/16

PP07 – MY-02 – 11/30/17

PP08 – MY-00 – 4/15/16

PP08 – MY-02 – 11/30/17

PP09 – MY-00 – 4/15/16

PP09 – MY-02 – 11/30/17

PP10 – MY-00 – 4/15/16

PP10 – MY-02 – 11/30/17

PP11 – MY-00 – 4/15/16

PP11 – MY-02 – 11/30/17

PP12 – MY-00 – 4/15/16

PP12 – MY-02 – 11/30/17

Appendix C

Vegetation Plot Data

Table 6. Vegetation Plot Criteria Attainment Norman's Pasture & Norman's Pasture II Restoration Sites				
Vegetation Plot ID	**Location**	**Vegetation Survival Threshold Met?**	**Monitoring Year 02 Planted Stem Density (stems/acre)**	**Monitoring Year 02 Total Stem Density (stems/acre)**
1	NPII	Yes	809	971
2	NPII	Yes	1,012	1,538
3	NPII	Yes	1,012	1,052
4	NPII	Yes	445	1,902
5	NPII	Yes	486	2,792
6	NPII	Yes	647	850
7	NPII	Yes	445	526
8	NPII	Yes	688	1,376
9	NPII	Yes	688	850
10	NPII	Yes	486	2,873
11	NPII	Yes	1,012	1,983
12	NPII	Yes	445	728
13	NPRS	Yes	445	728
14	NPRS	Yes	364	607
15	NPRS	Yes	971	1,416
16	NPRS	Yes	1,457	1,457
17	NPRS	Yes	1,497	1,538
18	NPRS	Yes	486	850
19	NPRS	Yes	1,497	1,700
20	NPRS	Yes	971	1,012
21	NPRS	Yes	931	1,174
22	NPRS	Yes	405	486
23	NPRS	Yes	890	1,376
24	NPRS	Yes	809	1,052
25	NPRS	Yes	809	1,012
26	NPRS	Yes	567	688
27	NPRS	Yes	728	3,359
28	NPRS	Yes	445	1,619
29	NPRS	Yes	688	1,578
30	NPRS	Yes	364	364
31	NPII	Yes	688	688

Table 7. CVS Vegetation Plot Metadata	
Norman's Pasture & Norman's Pasture II Restoration Sites	
Report Prepared By	Ben Grunwald
Date Prepared	8/15/2017 9:53
database name	KCI-2016-Normans.mdb
database location	M:\2012\20122925 Norman's Pasture FDP\Monitoring\Veg database
computer name	44-8PQ3J72
file size	50855936
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	95717
project Name	Norman's Pasture
Description	wetland restoration site
River Basin	Cape Fear

Table 8: CVS Stem Count Total and Planted by Plot and Species, Norman's Pasture and Norman's Pasture II Restoration Sites

DMS Project #: 95717/96310

			Current Plot Data																												
			95717-01-0001			95717-01-0002			95717-01-0003			95717-01-0004			95717-01-0005			95717-01-0006			95717-01-0007			95717-01-0008			95717-01-0009			95717-01-0010		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer rubrum	red maple	Tree						3			1			5			46			2			2			7			3			52
Alnus incana	gray alder																														
Alnus serrulata	hazel alder	Shrub																													
Baccharis	baccharis	Shrub																													
Baccharis halimifolia	eastern baccharis	Shrub						3						6			5														
Betula nigra	river birch	Tree	2	2	2	1	1	1	1	1	1	3	3	3	5	5	5	8	8	8	2	2	2	1	1	1				2	2	2
Cephalanthus occidentalis	common buttonbush	Shrub	1	1	1										1	1	1	1	1	1											
Cornus amomum	silky dogwood	Shrub																													
Corylus americana	American hazelnut	Shrub																													
Crataegus	hawthorn	Tree																								1					
Diospyros virginiana	common persimmon	Tree																													
Fraxinus pennsylvanica	green ash	Tree	3	3	3	3	3	4	5	5	5							1	1	1	3	3	3				4	4	4	2	2	3
Juglans nigra	black walnut	Tree			1												2						1	1	2						1
Liquidambar styraciflua	sweetgum	Tree			2															1			1			7						4
Liriodendron tulipifera	tuliptree	Tree	3	3	3	1	1	5				1	1	1										1	1	1	3	3	3	1	1	1
Morella cerifera	wax myrtle	shrub						2																							
Myrica	sweetgale	shrub																													
Nyssa aquatica	water tupelo	Tree																													
Nyssa biflora	swamp tupelo	Tree																													
Pinus palustris	longleaf pine	Tree															1														
Pinus taeda	loblolly pine	Tree																											1		
Prunus serotina	black cherry	Tree																								1					1
Quercus laurifolia	laurel oak	Tree	3	3	3	4	4	4	1	1	1							3	3	3	2	2	2	3	3	3	2	2	2	3	3	3
Quercus lyrata	overcup oak	Tree	5	5	5	6	6	6	5	5	5	1	1	1	3	3	3	1	1	1				4	4	4	2	2	2	1	1	1
Quercus michauxii	swamp chestnut oak	Tree	1	1	1	5	5	5	5	5	5	6	6	6	2	2	2	2	2	2	1	1	1	5	5	5	1	1	1	1	1	1
Quercus minima	dwarf live oak	Shrub																													
Quercus phellos	willow oak	Tree				1	1	1																							
Rhus copallinum	flameleaf sumac	shrub															2														
Salix nigra	black willow	Tree												25			1														
Taxodium distichum	bald cypress	Tree	2	2	2	4	4	4	8	8	8				1	1	1				2	2	2	2	2	2	5	5	5	2	2	2
Ulmus americana	American elm	Tree																													
Unknown		Shrub or Tree	1	1	1													2	2	2											
		Stem count	21	21	24	25	25	38	25	25	26	11	11	47	12	12	69	18	18	21	10	10	13	17	17	34	17	17	21	12	12	71
		size (ares)	1			1			1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	9	9	11	8	8	11	6	6	7	4	4	7	5	5	11	7	7	9	5	5	7	7	7	11	6	6	8	7	7	11
		Stems per ACRE	850	850	971	1012	1012	1538	1012	1012	1052	445	445	1902	486	486	2792	728	728	850	405	405	526	688	688	1376	688	688	850	486	486	2873

Table 8: CVS Stem Count Total and Planted by Plot and Species, Norman's Pasture and Norman's Pasture II Restoration Sites

DMS Project #: 95717/96310

			Current Plot Data																												
			95717-01-0011			95717-01-0012			95717-01-0013			95717-01-0014			95717-01-0015			95717-01-0016			95717-01-0017			95717-01-0018			95717-01-0019			95717-01-0020		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer rubrum	red maple	Tree			5			6			6			3			6						1			5			4			
Alnus incana	gray alder																														
Alnus serrulata	hazel alder	Shrub																										1			
Baccharis	baccharis	Shrub																													
Baccharis halimifolia	eastern baccharis	Shrub															2														
Betula nigra	river birch	Tree	3	3	3				1	1	1	1	1	1	2	2	2							2	2	2	3	3	3			
Cephalanthus occidentalis	common buttonbush	Shrub	6	6	6				2	2	2				2	2	2				6	6	6									
Cornus amomum	silky dogwood	Shrub																													
Corylus americana	American hazelnut	Shrub																													
Crataegus	hawthorn	Tree																								1					
Diospyros virginiana	common persimmon	Tree	1	1	3																										
Fraxinus pennsylvanica	green ash	Tree	4	4	4	3	3	3	3	3	3																				
Juglans nigra	black walnut	Tree	1	1	1									1																	
Liquidambar styraciflua	sweetgum	Tree						1			1			2												3					
Liriodendron tulipifera	tuliptree	Tree	2	2	2				1	1	1																				
Morella cerifera	wax myrtle	shrub																													
Myrica	sweetgale	shrub																													
Nyssa aquatica	water tupelo	Tree													11	11	11	4	4	4	14	14	14	6	6	6	14	14	14	11	11	11
Nyssa biflora	swamp tupelo	Tree																						1	1	1						
Pinus palustris	longleaf pine	Tree																													
Pinus taeda	loblolly pine	Tree			1												3														
Prunus serotina	black cherry	Tree															3														
Quercus laurifolia	laurel oak	Tree	3	3	3	1	1	1							5	5	5							2	2	2						
Quercus lyrata	overcup oak	Tree	2	2	2										2	2	2							1	1	1				3	3	3
Quercus michauxii	swamp chestnut oak	Tree	3	3	3				3	3	3	1	1	1	1	1	1				1	1	1				11	11	11	1	1	1
Quercus minima	dwarf live oak	Shrub																													
Quercus phellos	willow oak	Tree													1	1	1														
Rhus copallinum	flameleaf sumac	shrub			16																										
Salix nigra	black willow	Tree																													1
Taxodium distichum	bald cypress	Tree				7	7	7	1	1	1	7	7	7				32	32	32	16	16	16				9	9	9	9	9	9
Ulmus americana	American elm	Tree																													
Unknown		Shrub or Tree																													
Stem count			25	25	49	11	11	18	11	11	18	9	9	15	24	24	35	36	36	36	37	37	38	12	12	21	37	37	42	24	24	25
size (ares)			1			1			1			1			1			1			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			9	9	12	3	3	5	6	6	8	3	3	6	7	7	10	2	2	2	4	4	5	5	5	8	4	4	6	4	4	5
Stems per ACRE			1012	1012	1983	445	445	728	445	445	728	364	364	607	971	971	1416	1457	1457	1457	1497	1497	1538	486	486	850	1497	1497	1700	971	971	1012

Table 8: CVS Stem Count Total and Planted by Plot and Species, Norman's Pasture and Norman's Pasture II Restoration Sites

DMS Project #: 95717/96310			Current Plot Data																												
			95717-01-0021			95717-01-0022			95717-01-0023			95717-01-0024			95717-01-0025			95717-01-0026			95717-01-0027			95717-01-0028			95717-01-0029			95717-01-0030		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree			2															1			4						14			
Alnus incana	gray alder																															
Alnus serrulata	hazel alder	Shrub																		1			11									
Baccharis	baccharis	Shrub																														
Baccharis halimifolia	eastern baccharis	Shrub																														
Betula nigra	river birch	Tree	4	4	4						1				1	1	1	4	4	4			34				1	1	1			
Cephalanthus occidentalis	common buttonbush	Shrub	2	2	2	1	1	1										3	3	3	2	2	2				1	1	1	3	3	3
Cornus amomum	silky dogwood	Shrub																														
Corylus americana	American hazelnut	Shrub																														
Crataegus	hawthorn	Tree															1									1			2			
Diospyros virginiana	common persimmon	Tree																						2	2	29						
Fraxinus pennsylvanica	green ash	Tree																														
Juglans nigra	black walnut	Tree															1															
Liquidambar styraciflua	sweetgum	Tree			4												2			1			8						5			
Liriodendron tulipifera	tuliptree	Tree																														
Morella cerifera	wax myrtle	shrub																														
Myrica	sweetgale	shrub																														
Nyssa aquatica	water tupelo	Tree	3	3	3				6	6	6	1	1	1										4	4	4				1	1	1
Nyssa biflora	swamp tupelo	Tree													1	1	1															
Pinus palustris	longleaf pine	Tree																														
Pinus taeda	loblolly pine	Tree																														
Prunus serotina	black cherry	Tree																														
Quercus laurifolia	laurel oak	Tree	5	5	5	1	1	1	1	1	1				6	6	6	2	2	2	5	5	5	3	3	3				4	4	4
Quercus lyrata	overcup oak	Tree				1	1	1							8	8	8				8	8	8				9	9	10			
Quercus michauxii	swamp chestnut oak	Tree	2	2	2				1	1	1				1	1	1				2	2	2									
Quercus minima	dwarf live oak	Shrub																														
Quercus phellos	willow oak	Tree																														
Rhus copallinum	flameleaf sumac	shrub																														
Salix nigra	black willow	Tree						2			9			6									5									
Taxodium distichum	bald cypress	Tree	7	7	7	7	7	7	14	14	14	19	19	19	3	3	3	5	5	5	1	1	1	2	2	2	6	6	6	1	1	1
Ulmus americana	American elm	Tree									1						1						3			1						
Unknown		Shrub or Tree							1	1	1																					
Stem count			23	23	29	10	10	12	23	23	34	20	20	26	20	20	25	14	14	17	18	18	83	11	11	40	17	17	39	9	9	9
size (ares)			1			1			1			1			1			1			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			6	6	8	4	4	5	5	5	8	2	2	3	6	6	10	4	4	7	5	5	11	4	4	6	4	4	7	4	4	4
Stems per ACRE			931	931	1174	405	405	486	931	931	1376	809	809	1052	809	809	1012	567	567	688	728	728	3359	445	445	1619	688	688	1578	364	364	364

Table 8: CVS Stem Count Total and Planted by Plot and Species, Norman's Pasture and Norman's Pasture II Restoration Sites																
DMS Project #: 95717/96310			Current Plot Data			Annual Means										
			95717-01-0031			MY2 (2017)			MY1 (2016)			MY0 (2016)				
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T		
Acer rubrum	red maple	Tree						178			92					
Alnus incana	gray alder										4					
Alnus serrulata	hazel alder	Shrub						13								
Baccharis	baccharis	Shrub									2					
Baccharis halimifolia	eastern baccharis	Shrub						16								
Betula nigra	river birch	Tree	1	1	1	48	48	83	47	47	61	42	42	42		
Cephalanthus occidentalis	common buttonbush	Shrub				31	31	31	21	21	21					
Cornus amomum	silky dogwood	Shrub							2	2	2					
Corylus americana	American hazelnut	Shrub							4	4	4					
Crataegus	hawthorn	Tree						6			1					
Diospyros virginiana	common persimmon	Tree				3	3	32								
Fraxinus pennsylvanica	green ash	Tree	1	1	1	32	32	34	30	30	31	36	36	36		
Juglans nigra	black walnut	Tree				2	2	9	2	2	5					
Liquidambar styraciflua	sweetgum	Tree						42			29					
Liriodendron tulipifera	tuliptree	Tree	5	5	5	18	18	22	19	19	21	10	10	10		
Morella cerifera	wax myrtle	shrub						2								
Myrica	sweetgale	shrub									1					
Nyssa aquatica	water tupelo	Tree				75	75	75	79	79	79	60	60	60		
Nyssa biflora	swamp tupelo	Tree				2	2	2	2	2	2					
Pinus palustris	longleaf pine	Tree						1								
Pinus taeda	loblolly pine	Tree						5								
Prunus serotina	black cherry	Tree						2			1					
Quercus laurifolia	laurel oak	Tree	5	5	5	64	64	64	70	70	70	68	68	68		
Quercus lyrata	overcup oak	Tree	1	1	1	63	63	64	65	65	65	33	33	33		
Quercus michauxii	swamp chestnut oak	Tree	3	3	3	59	59	59	60	60	60	41	41	41		
Quercus minima	dwarf live oak	Shrub										1	1	1		
Quercus phellos	willow oak	Tree				2	2	2	3	3	3	1	1	1		
Rhus copallinum	flameleaf sumac	shrub						18			5					
Salix nigra	black willow	Tree						49			26					
Taxodium distichum	bald cypress	Tree	1	1	1	173	173	173	171	171	171	169	169	169		
Ulmus americana	American elm	Tree						6			6					
Unknown		Shrub or Tree				4	4	4	21	21	35	213	213	213		
Stem count			17	17	17	576	576	992	596	596	797	674	674	674		
size (ares)			1			31			31			31				
size (ACRES)			0.02			0.77			0.77			0.77				
Species count			7	7	7	14	14	26	15	15	25	11	11	11		
Stems per ACRE			688	688	688	752	752	1295	778	778	1040	880	880	880		

Appendix D

Hydrologic Data

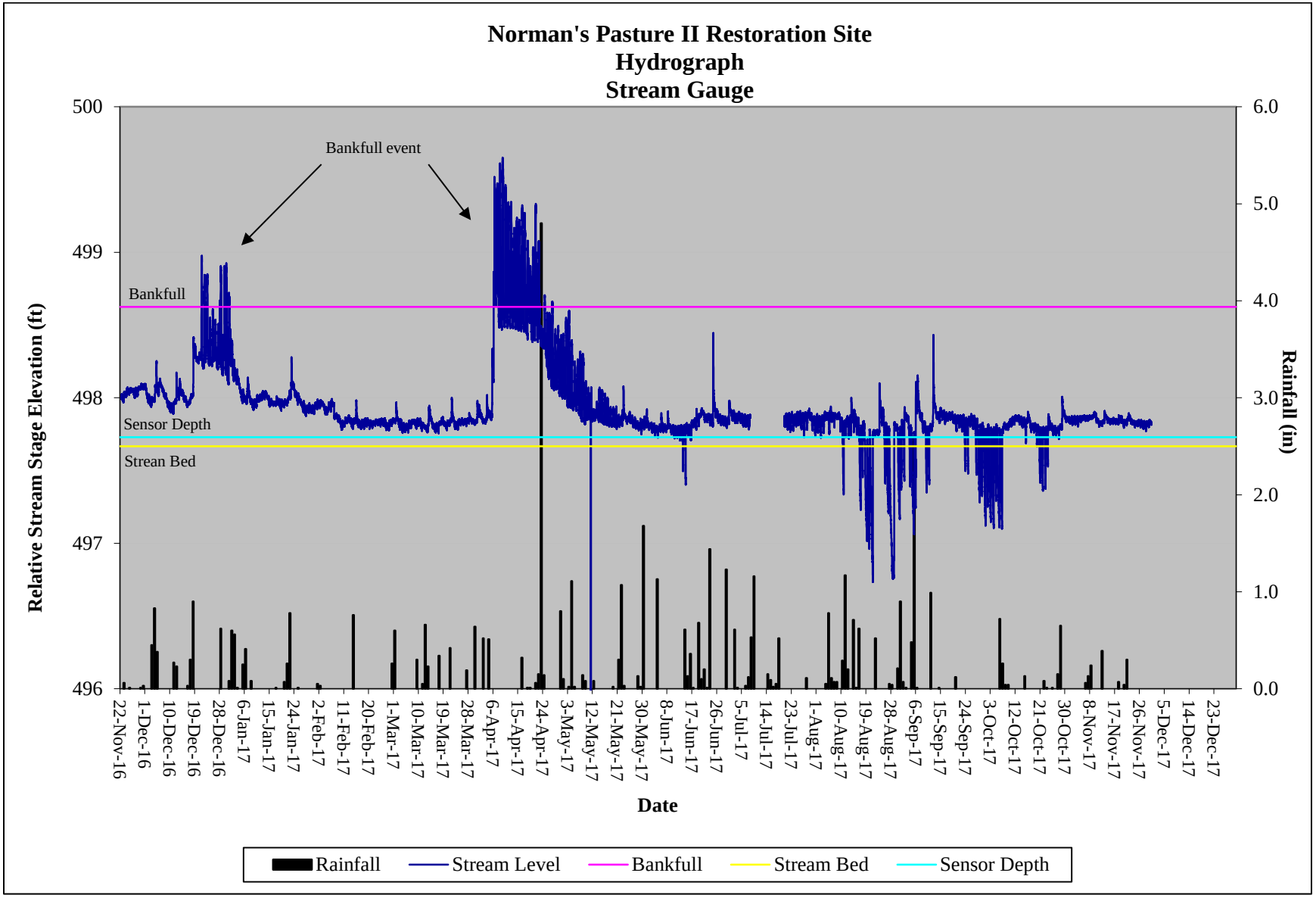
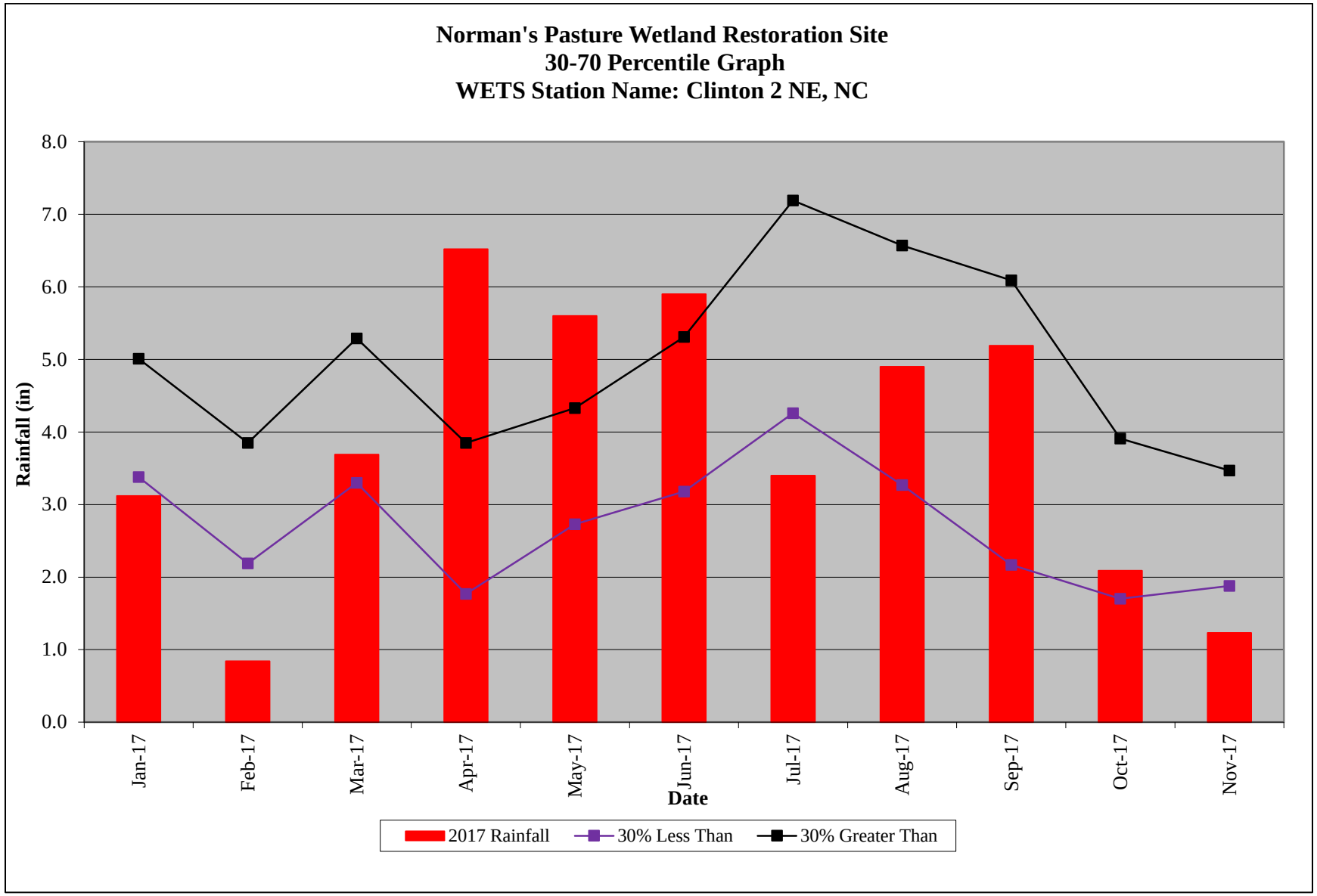
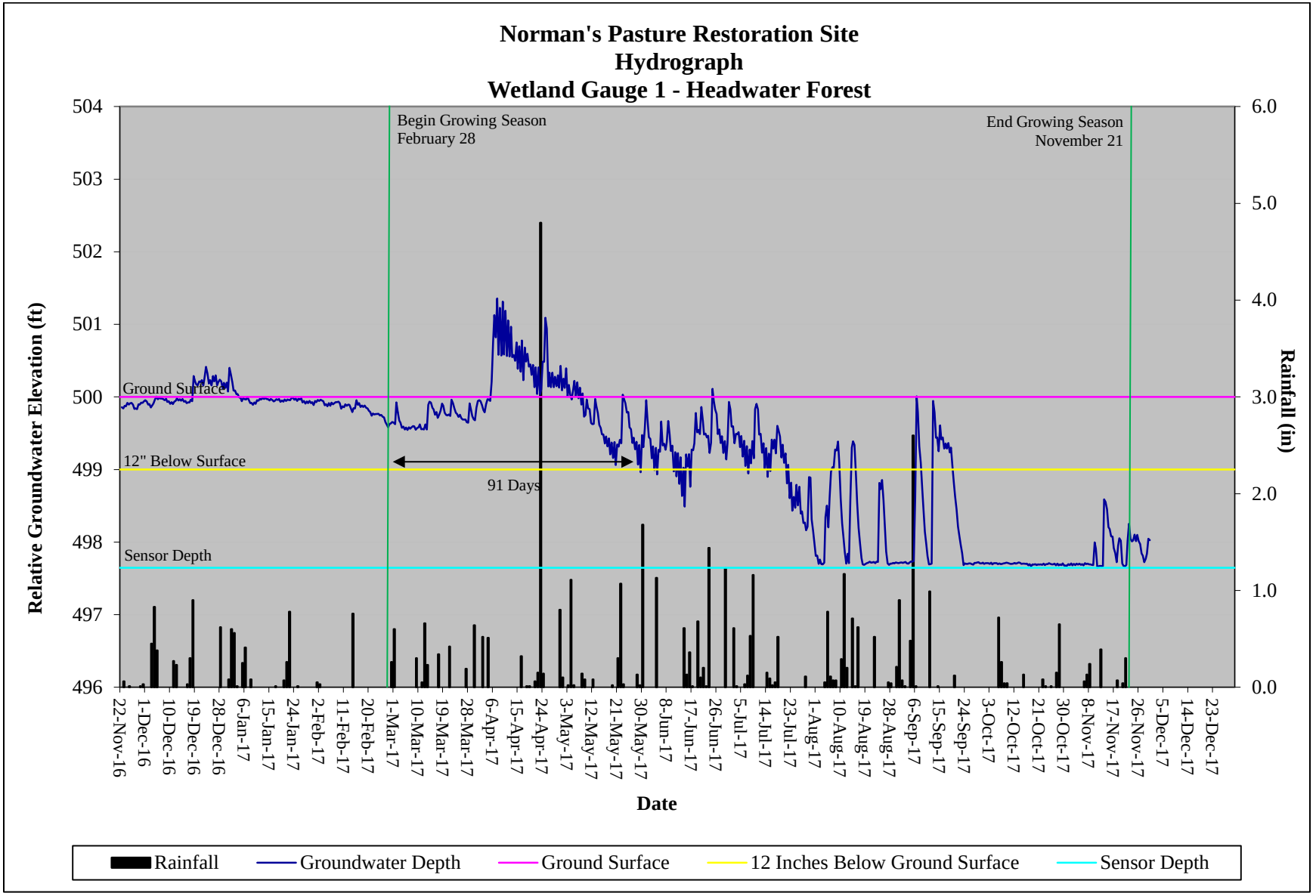

Norman's Pasture II Restoration Site
Hydrograph
Stream Gauge
Relative Stream Stage Elevation (ft)
Rainfall (in)
Date
Bankfull event
Bankfull
Sensor Depth
Strean Bed
500
499
498
497
496
6.0
5.0
4.0
3.0
2.0
1.0
0.0
22-Nov-16
1-Dec-16
10-Dec-16
19-Dec-16
28-Dec-16
6-Jan-17
15-Jan-17
24-Jan-17
2-Feb-17
11-Feb-17
20-Feb-17
1-Mar-17
10-Mar-17
19-Mar-17
28-Mar-17
6-Apr-17
15-Apr-17
24-Apr-17
3-May-17
12-May-17
21-May-17
30-May-17
8-Jun-17
17-Jun-17
26-Jun-17
5-Jul-17
14-Jul-17
23-Jul-17
1-Aug-17
10-Aug-17
19-Aug-17
28-Aug-17
6-Sep-17
15-Sep-17
24-Sep-17
3-Oct-17
12-Oct-17
21-Oct-17
30-Oct-17
8-Nov-17
17-Nov-17
26-Nov-17
5-Dec-17
14-Dec-17
23-Dec-17
Rainfall
Stream Level
Bankfull
Stream Bed
Sensor Depth

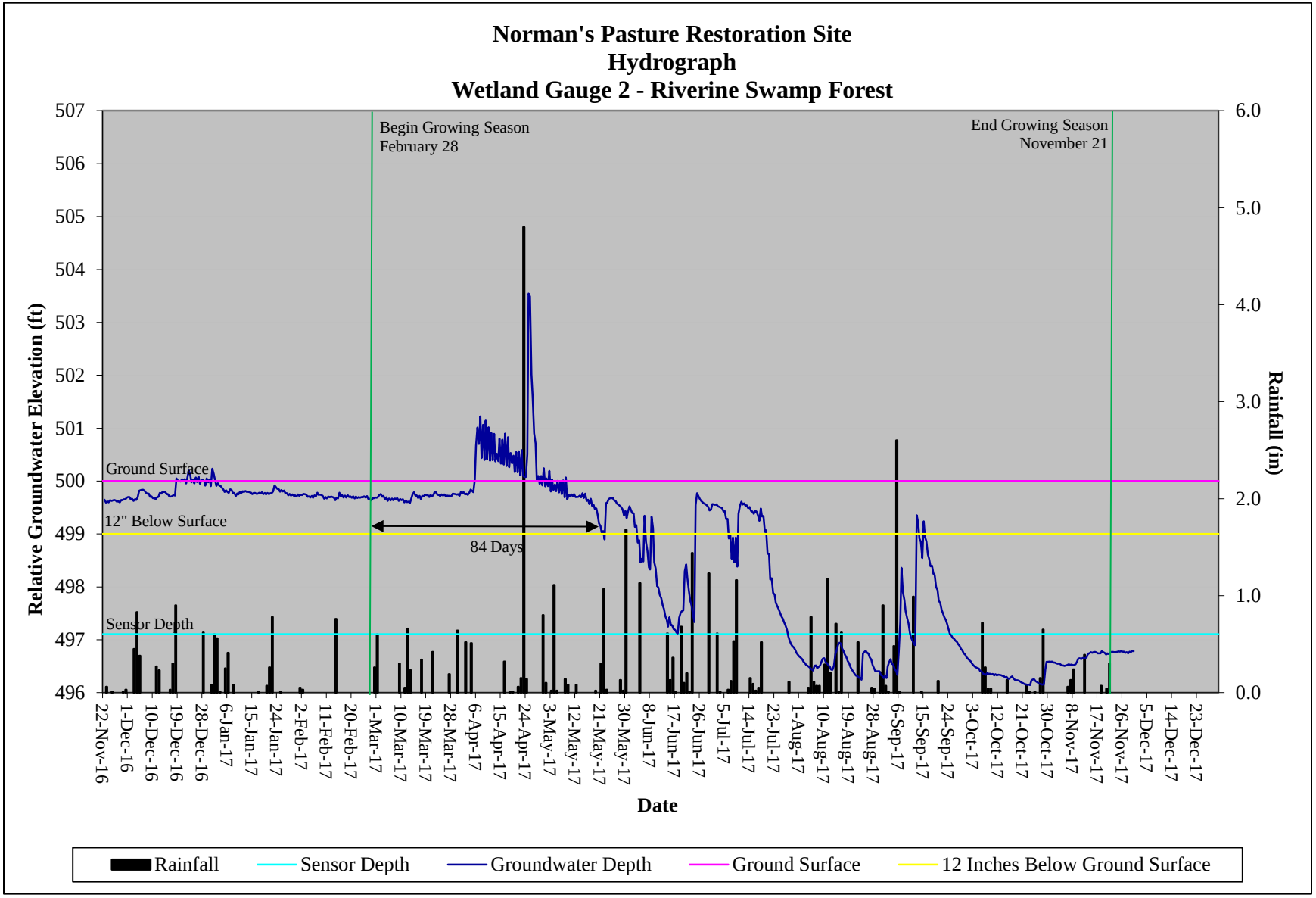
Table 9. Verification of Bankfull Events Norman's Pasture and Norman's Pasture II Restoration Sites, DMS Project Number 95717/96310			
Date of Data Collection	**Date of Occurrence**	**Method**	**Photo Number**
7/15/2016	7/15/2016	On-site automatic gauge	N/A
8/7/2016	8/7/2016	On-site automatic gauge	N/A
10/8/2016	10/8/2016	On-site automatic gauge	N/A
12/21/2016	12/21/2016	On-site automatic gauge	N/A
12/23/2016	12/23/2016	On-site automatic gauge	N/A
12/28/2016	12/28/2016	On-site automatic gauge	N/A
12/30/2016	12/30/2016	On-site automatic gauge	N/A
4/6 - 4/22/2017	4/6 - 4/22/2017	On-site automatic gauge	N/A
4/24/2017	4/24/2017	On-site automatic gauge	N/A
4/27/2017	4/27/2017	On-site automatic gauge	N/A

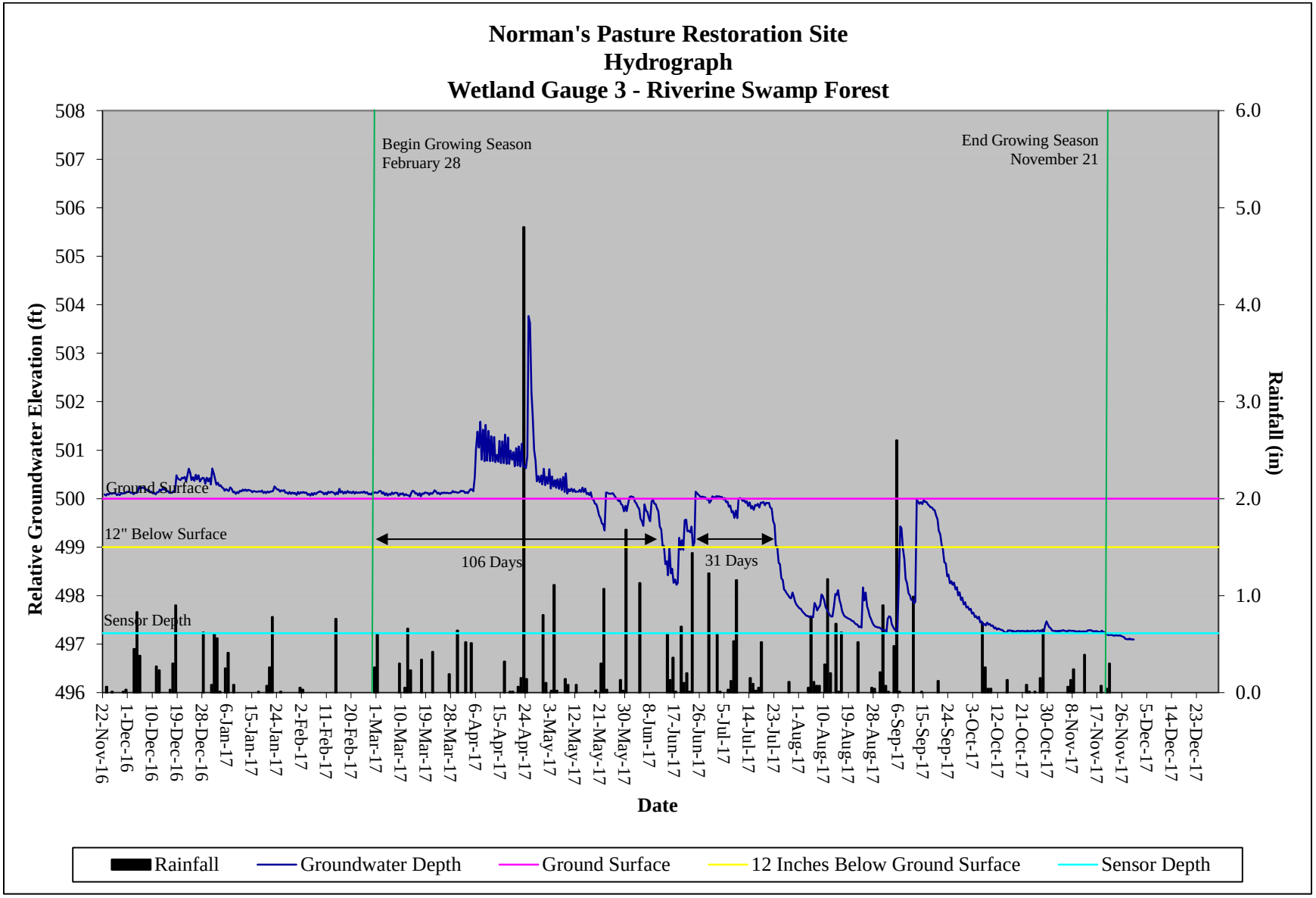
Table 10. Wetland Hydrology Criteria Attainment Norman's Pasture and Norman's Pasture II Restoration Sites, DMS Project Number 95717/96310								
Gauge Number	**Gauge Location**	**MY-01 (2016)**	**MY-02 (2017)**	**MY-03 (2018)**	**MY-04 (2019)**	**MY-05 (2020)**	**MY-06 (2021)**	**MY-07 (2022)**
NP1	Headwater Forest	Yes/111 (41.6%)	Yes/91 (34.1%)					
NP2	Riverine Swamp Forest	Yes/98 (36.7%)	Yes/84 (31.5%)					
NP3	Riverine Swamp Forest	Yes/99 (37.1%)	Yes/106 (39.7%)					
NP4	Riverine Swamp Forest	Yes/81 (30.3%)	Yes/105 (39.3%)					
NP5	Riverine Swamp Forest	Yes/64 (24.0%)	Yes/41 (15.4%)					
NP6	Riverine Swamp Forest	Yes/100 (37.5%)	Yes/103 (38.6%)					
NP7	Riverine Swamp Forest	Yes/64 (24.0%)	Yes/77 (28.8%)					
NP8	Riverine Swamp Forest	No/30 (11.2%)	Yes/58 (21.7%)					
NP9	Riverine Swamp Forest	Yes/39 (14.6%)	Yes/59 (22.1%)					
NPII 1	Headwater Forest	Yes/65 (24.3%)	Yes.77 (28.8%)					
NPII 2	Headwater Forest	Yes/81 (30.3%)	Yes/78 (29.2%)					
NPII 3	Headwater Forest	Yes/50 (18.7%)	Yes/77 (28.8%)					
NPII 4	Headwater Forest	Yes/64 (24.0%)	Yes/65 (24.3%)					
NPII 5	Headwater Forest	No/22 (8.2%)	Yes/35 (13.1%)					
NPII 6	Headwater Forest	No/6 (2.2%)	No/7 (2.6%)					
NPII 7	Headwater Forest	Yes/29 (10.9%)	Yes/53 (19.9%)					
NPII 8	Headwater Forest	No/12 (4.5%)	No/7 (2.6%)					
NPII 9	Headwater Forest	No/18 (6.7%)	Yes/35 (13.1%)					
NPII 10	Headwater Forest	No/18 (6.7%)	Yes/33 (12.4%)					
NPII 11	Headwater Forest	No/9 (3.4%)	Yes/31 (11.6%)					
NPII 12	Headwater Forest	Yes/27 (10.1%)	Yes/58 (21.7%)					
NPII 13	Headwater Forest	Yes/64 (24.0%)	Yes/81 (30.3%)					
NPC1*	Non-credited Creation Area	No/11 (4.1%)	Yes/58 (21.7%)					
NPC2*	Non-credited Creation Area	Yes/24 (9.0%)	Yes/81 (30.3%)					

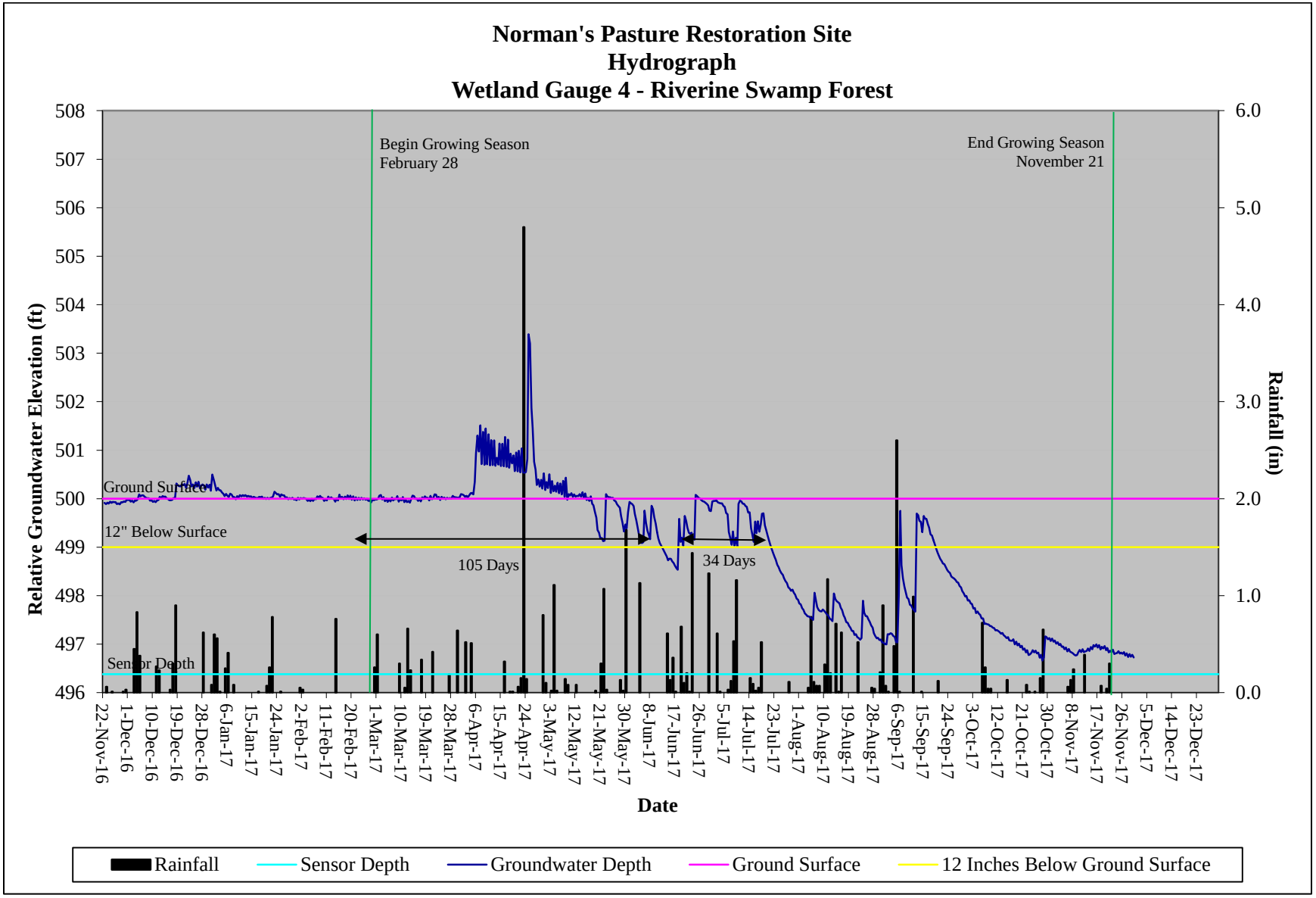
*= installed October 5, 2016

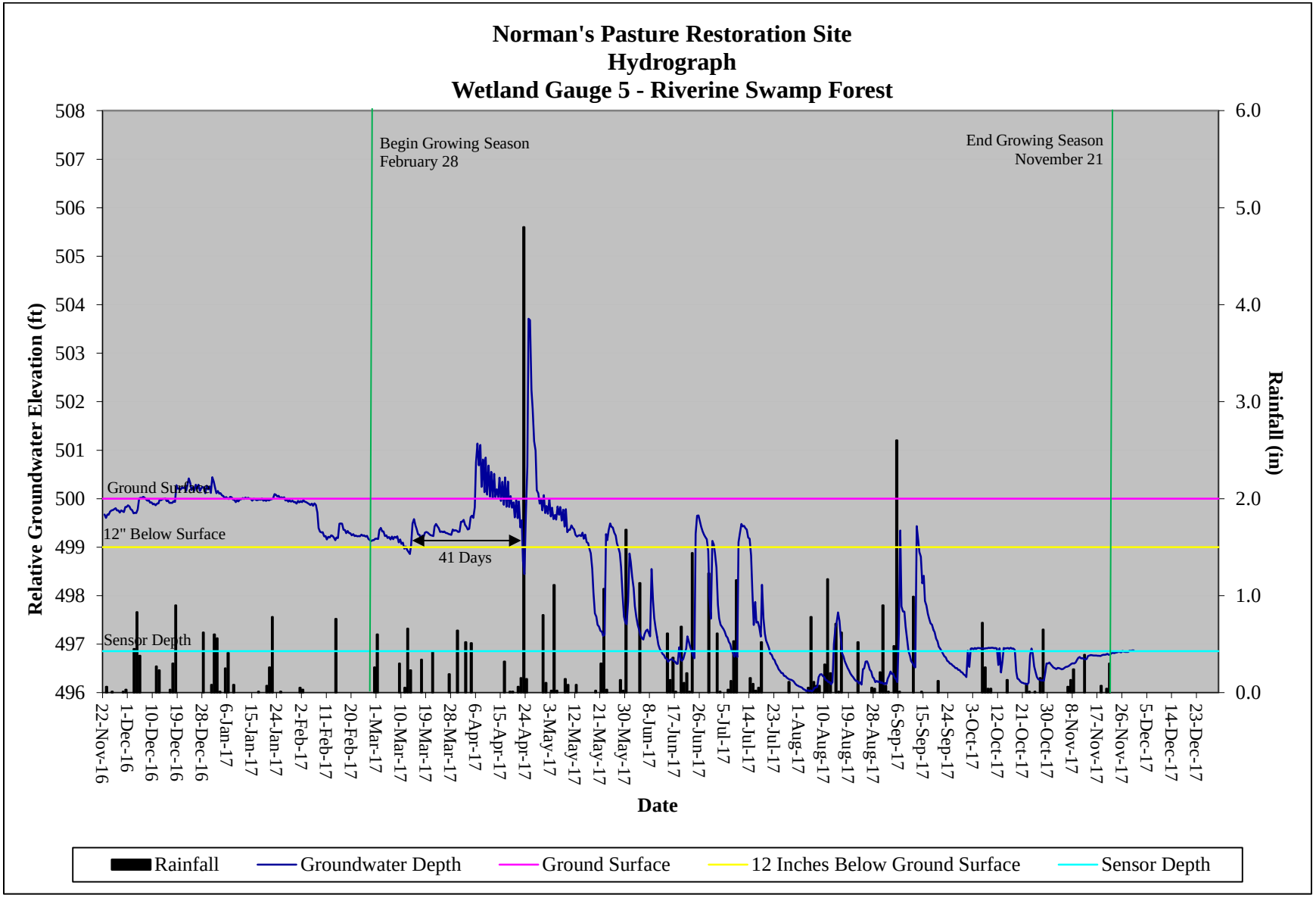

Norman's Pasture Wetland Restoration Site
30-70 Percentile Graph
WETS Station Name: Clinton 2 NE, NC
Rainfall (in)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Date
2017 Rainfall
30% Less Than
30% Greater Than

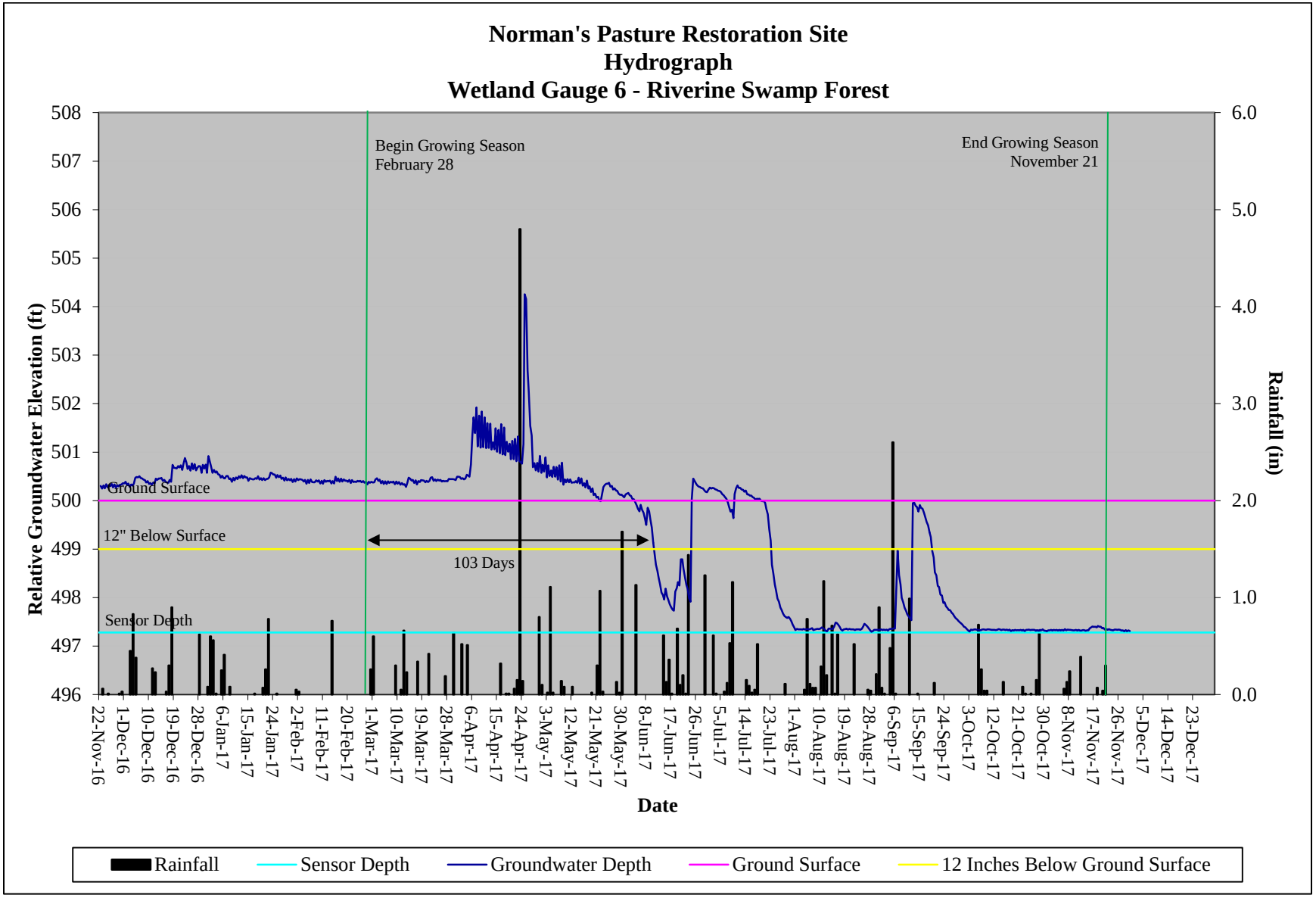

Norman's Pasture Restoration Site
Hydrograph
Wetland Gauge 1 - Headwater Forest
Begin Growing Season
February 28
End Growing Season
November 21
Ground Surface
12" Below Surface
91 Days
Sensor Depth
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
504
503
502
501
500
499
498
497
496
6.0
5.0
4.0
3.0
2.0
1.0
0.0
22-Nov-16
1-Dec-16
10-Dec-16
19-Dec-16
28-Dec-16
6-Jan-17
15-Jan-17
24-Jan-17
2-Feb-17
11-Feb-17
20-Feb-17
1-Mar-17
10-Mar-17
19-Mar-17
28-Mar-17
6-Apr-17
15-Apr-17
24-Apr-17
3-May-17
12-May-17
21-May-17
30-May-17
8-Jun-17
17-Jun-17
26-Jun-17
5-Jul-17
14-Jul-17
23-Jul-17
1-Aug-17
10-Aug-17
19-Aug-17
28-Aug-17
6-Sep-17
15-Sep-17
24-Sep-17
3-Oct-17
12-Oct-17
21-Oct-17
30-Oct-17
8-Nov-17
17-Nov-17
26-Nov-17
5-Dec-17
14-Dec-17
23-Dec-17
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth

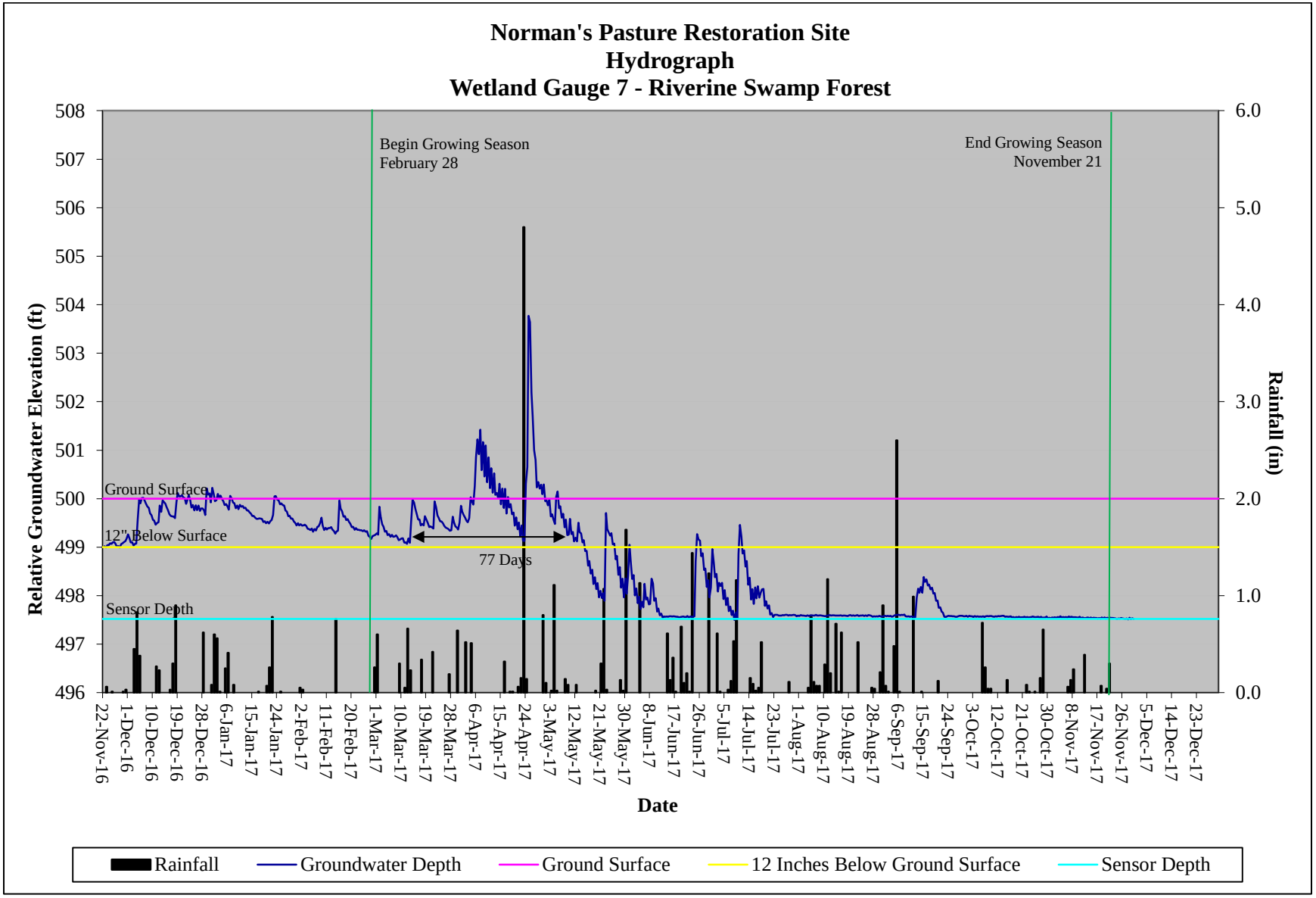

Norman's Pasture Restoration Site
Hydrograph
Wetland Gauge 2 - Riverine Swamp Forest
Begin Growing Season
February 28
End Growing Season
November 21
Ground Surface
12" Below Surface
84 Days
Sensor Depth
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Sensor Depth
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface

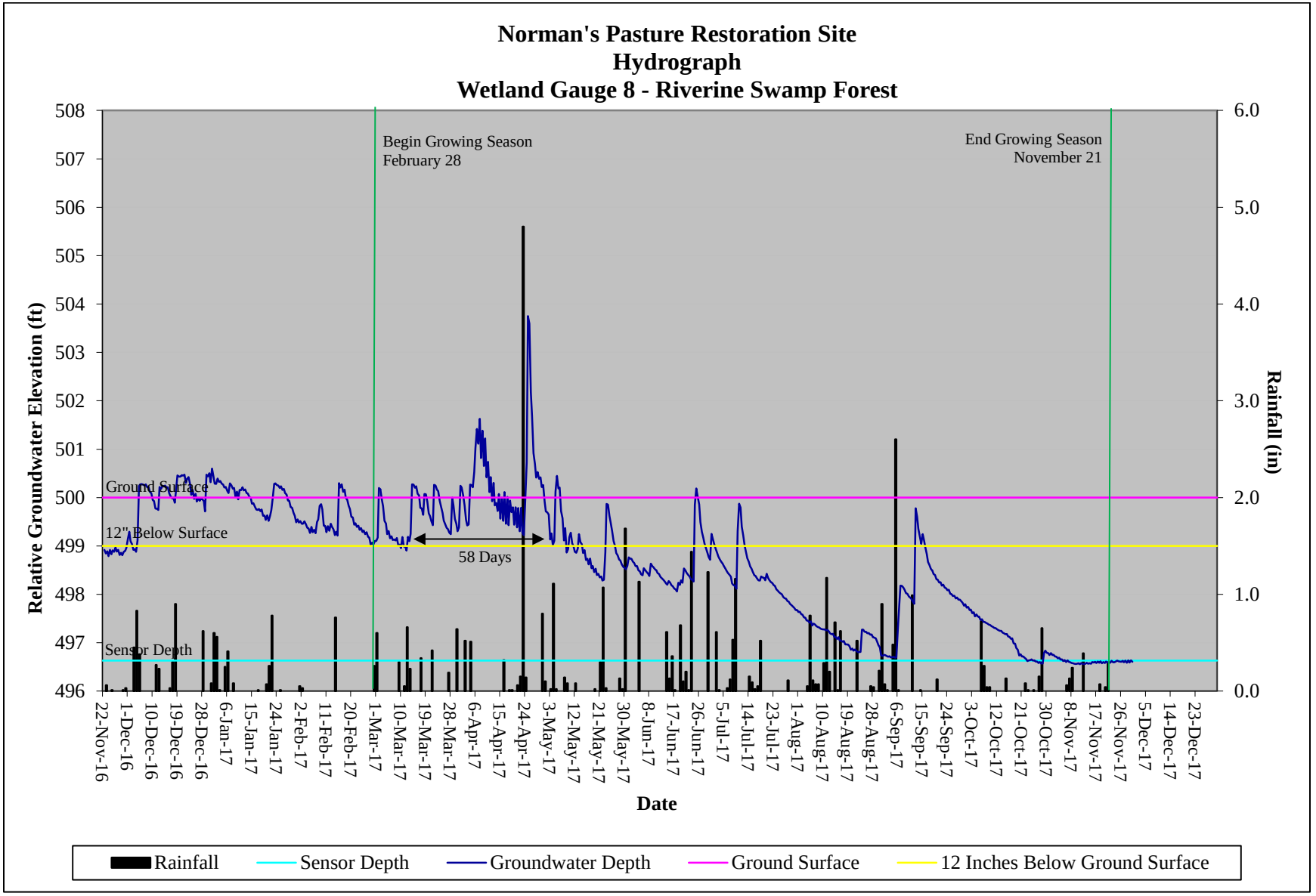

Norman's Pasture Restoration Site
Hydrograph
Wetland Gauge 3 - Riverine Swamp Forest
Relative Groundwater Elevation (ft)
Rainfall (in)
Begin Growing Season
February 28
End Growing Season
November 21
Ground Surface
12" Below Surface
Sensor Depth
106 Days
31 Days
Date
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth

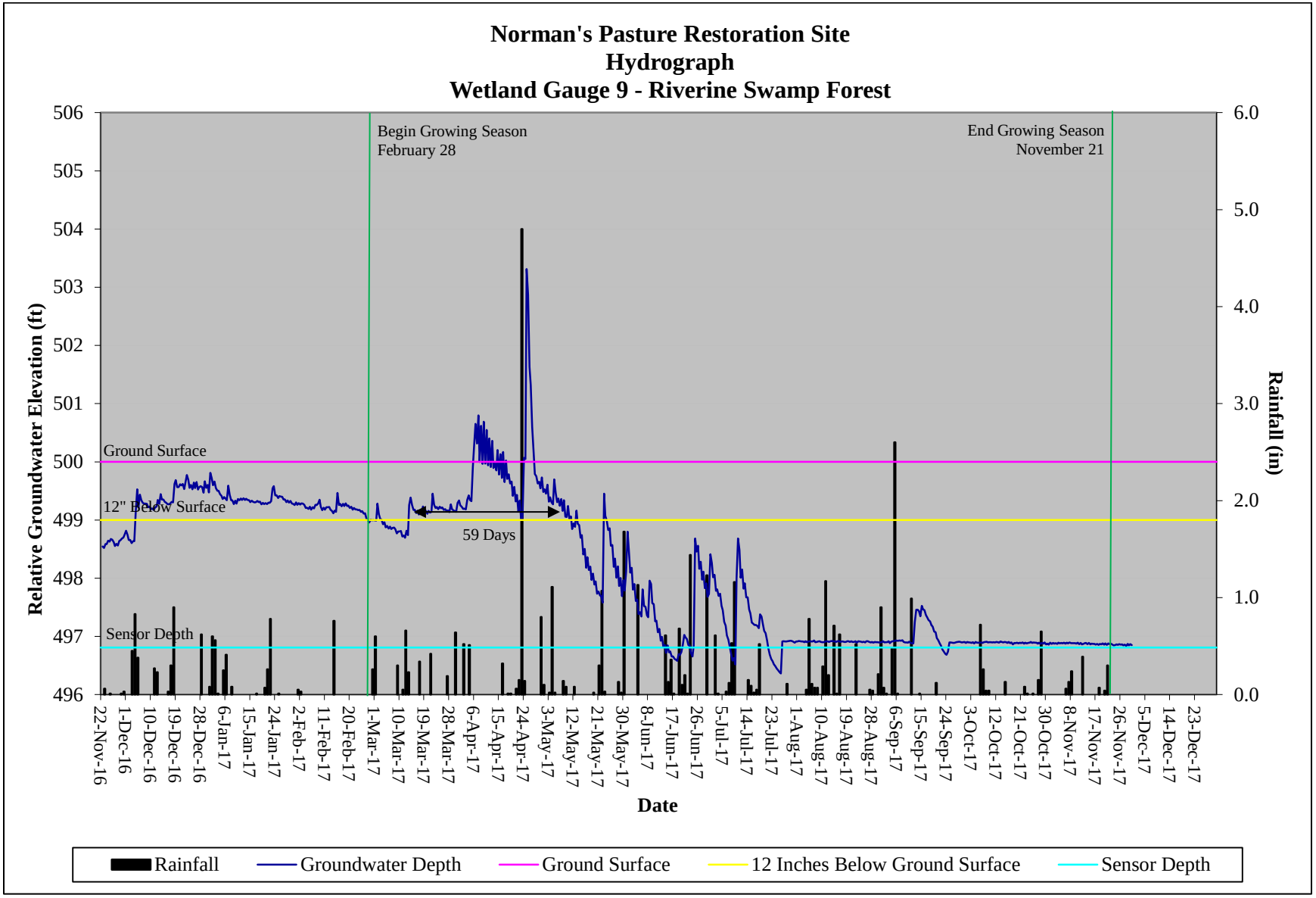

Norman's Pasture Restoration Site
Hydrograph
Wetland Gauge 4 - Riverine Swamp Forest
Relative Groundwater Elevation (ft)
Rainfall (in)
Begin Growing Season
February 28
End Growing Season
November 21
Ground Surface
12" Below Surface
105 Days
34 Days
Sensor Depth
Date
Rainfall
Sensor Depth
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface

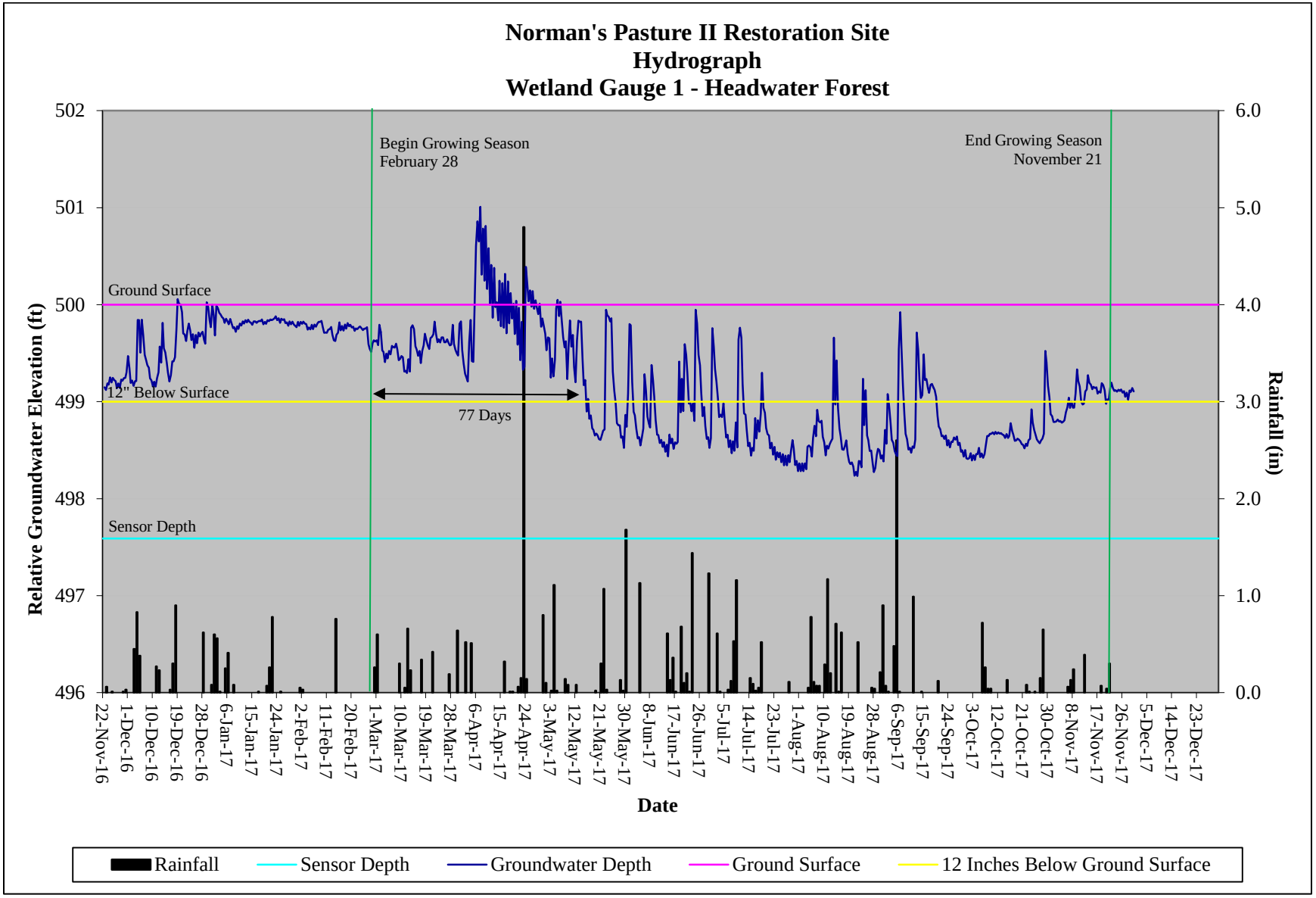

Norman's Pasture Restoration Site
Hydrograph
Wetland Gauge 5 - Riverine Swamp Forest
Begin Growing Season
February 28
End Growing Season
November 21
Ground Surface
12" Below Surface
41 Days
Sensor Depth
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth

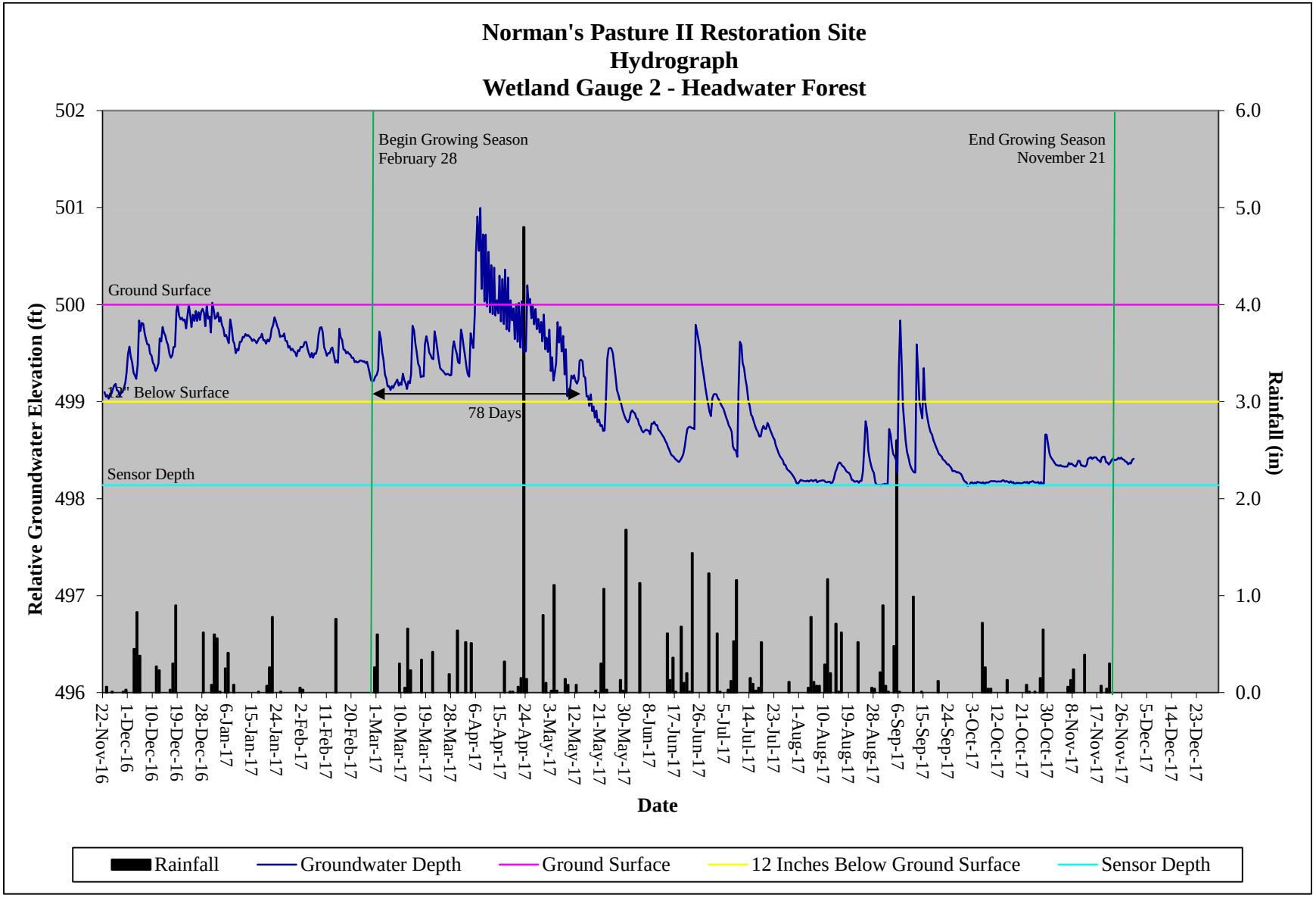

Norman's Pasture Restoration Site
Hydrograph
Wetland Gauge 6 - Riverine Swamp Forest
Begin Growing Season
February 28
End Growing Season
November 21
Ground Surface
12" Below Surface
103 Days
Sensor Depth
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Sensor Depth
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface

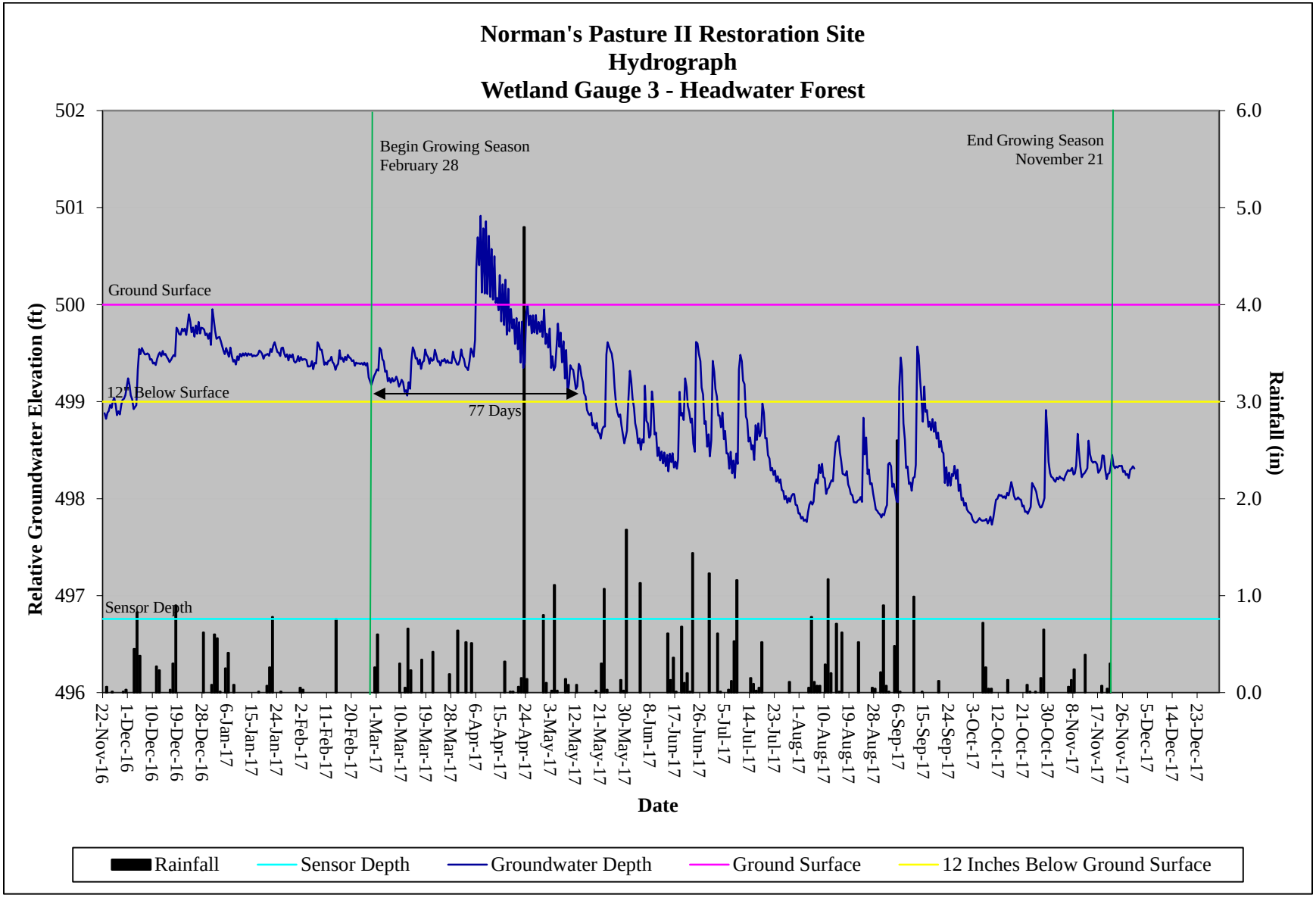

Norman's Pasture Restoration Site
Hydrograph
Wetland Gauge 7 - Riverine Swamp Forest
Relative Groundwater Elevation (ft)
Rainfall (in)
Begin Growing Season
February 28
End Growing Season
November 21
Ground Surface
12" Below Surface
77 Days
Sensor Depth
Date
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth

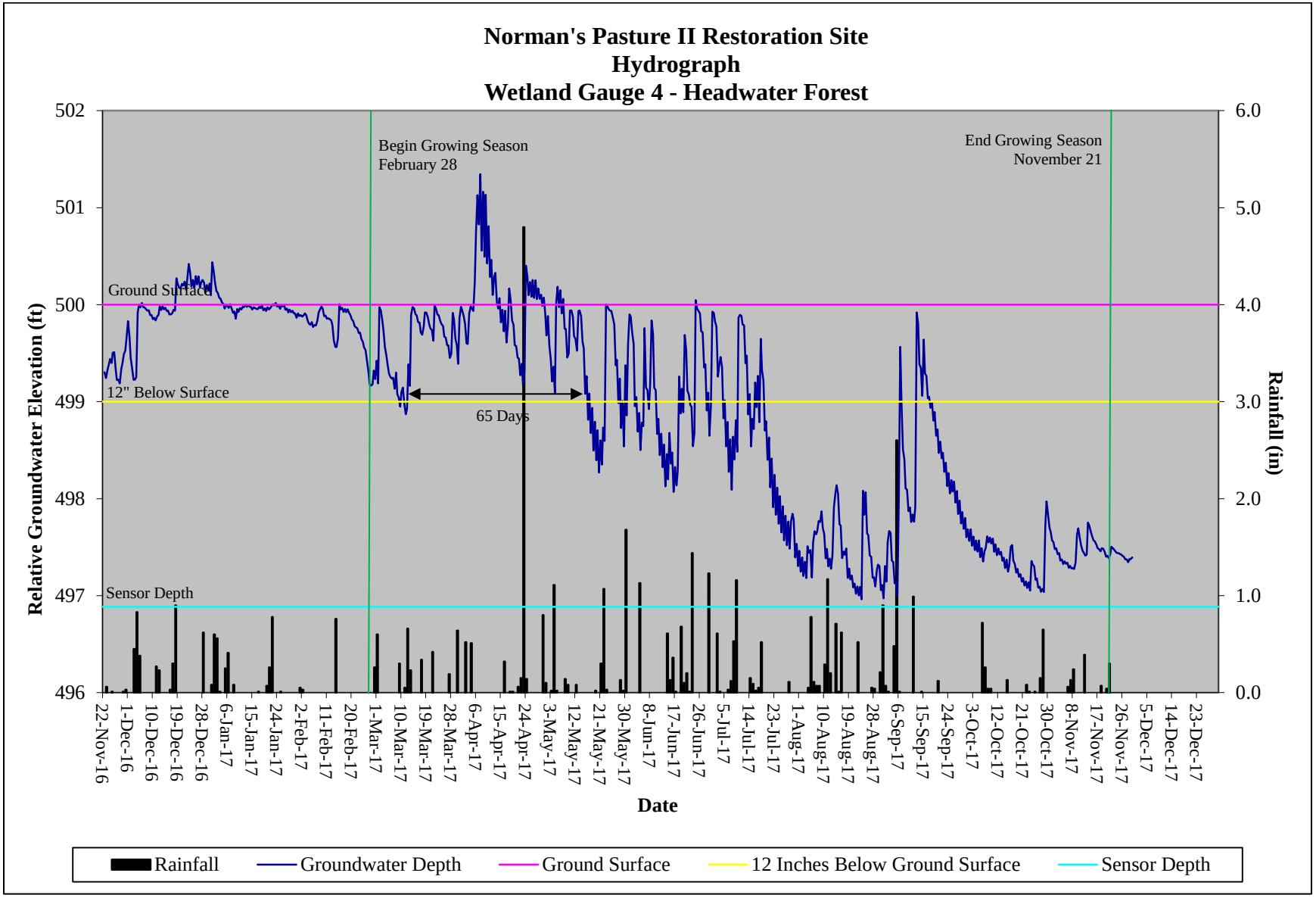

Norman's Pasture Restoration Site
Hydrograph
Wetland Gauge 8 - Riverine Swamp Forest
Begin Growing Season
February 28
End Growing Season
November 21
Ground Surface
12" Below Surface
58 Days
Sensor Depth
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Sensor Depth
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface

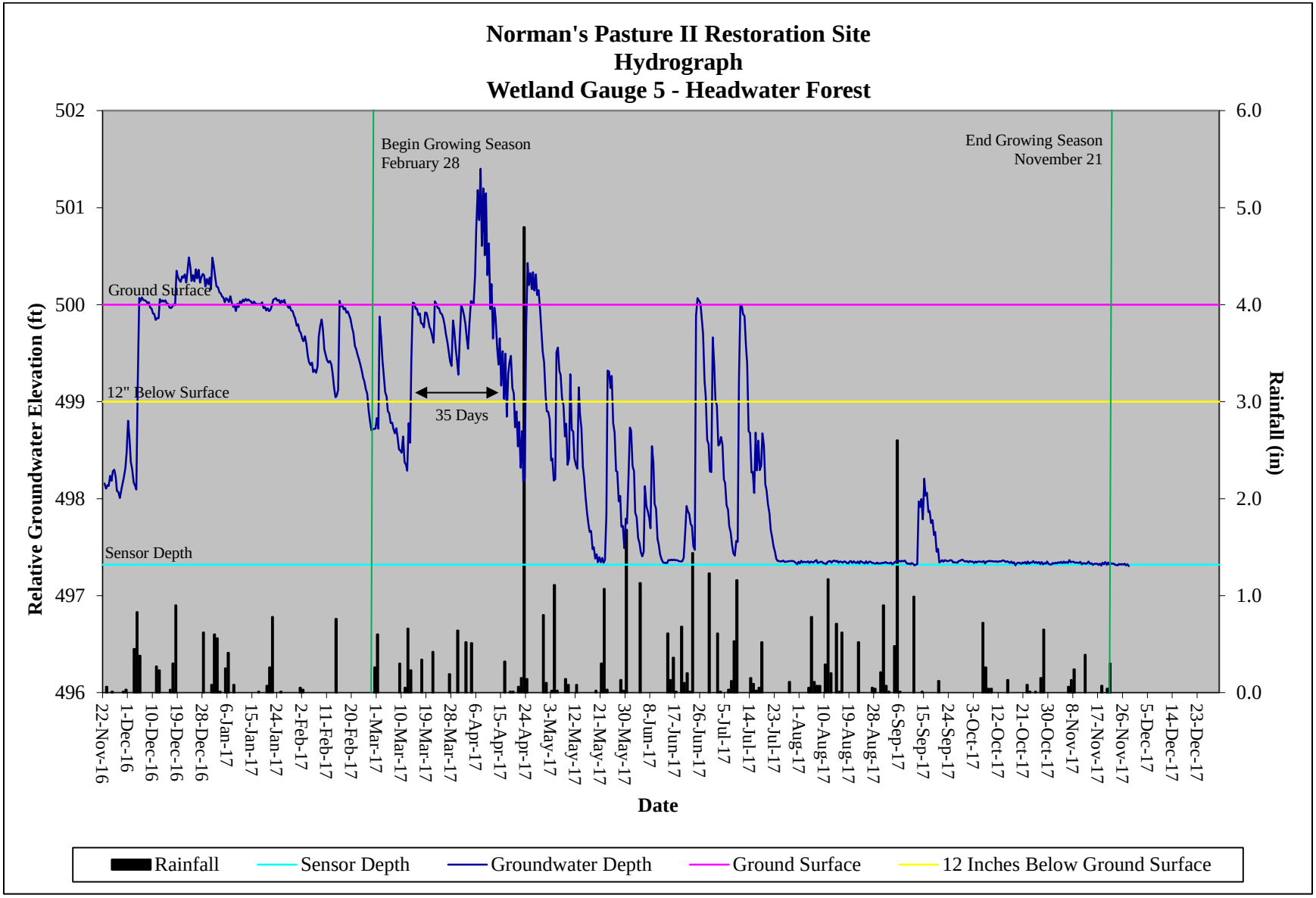

Norman's Pasture Restoration Site
Hydrograph
Wetland Gauge 9 - Riverine Swamp Forest
Begin Growing Season
February 28
End Growing Season
November 21
Ground Surface
12" Below Surface
59 Days
Sensor Depth
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth

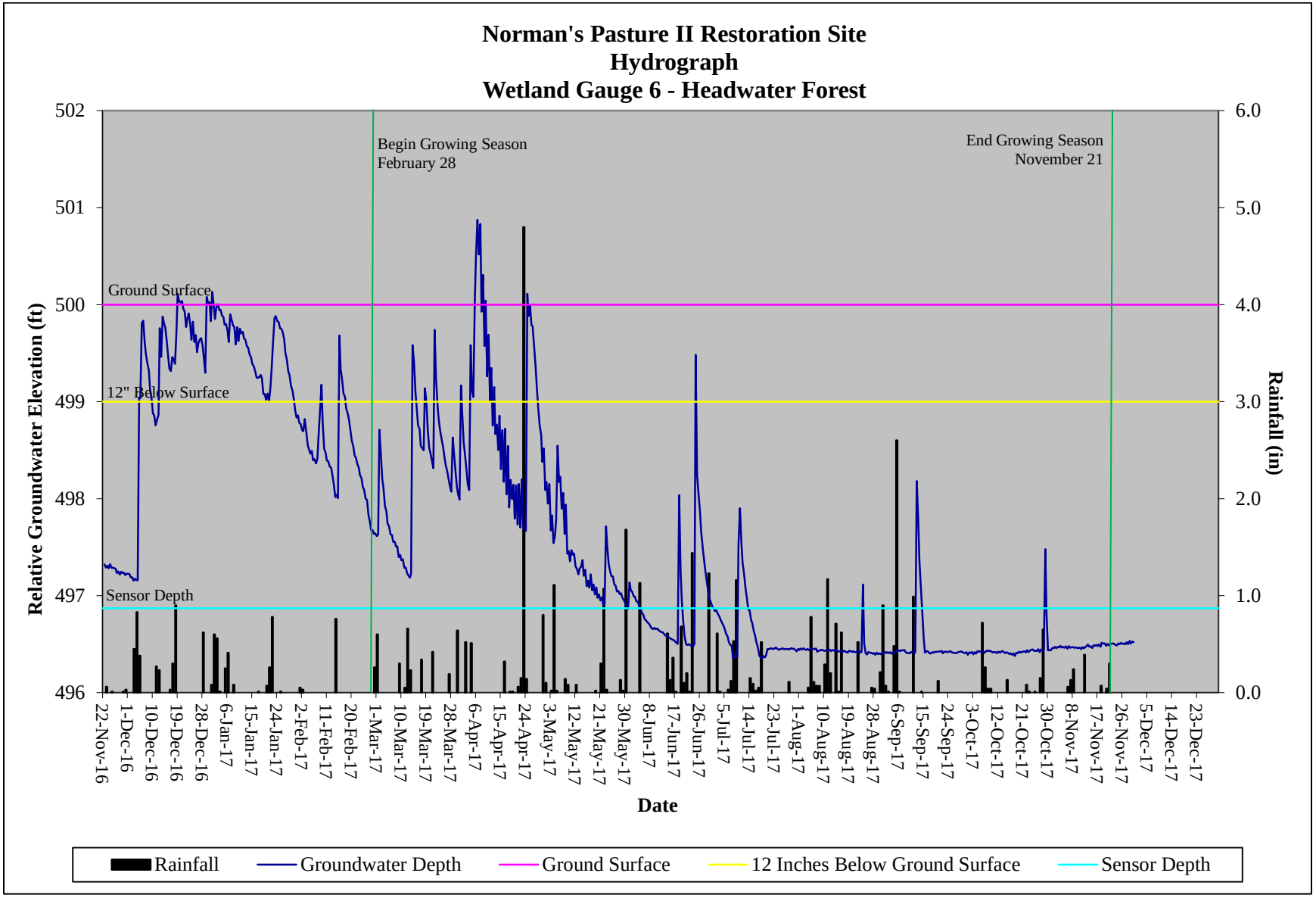

Norman's Pasture II Restoration Site
Hydrograph
Wetland Gauge 1 - Headwater Forest
Begin Growing Season
February 28
End Growing Season
November 21
Ground Surface
12" Below Surface
77 Days
Sensor Depth
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Sensor Depth
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface

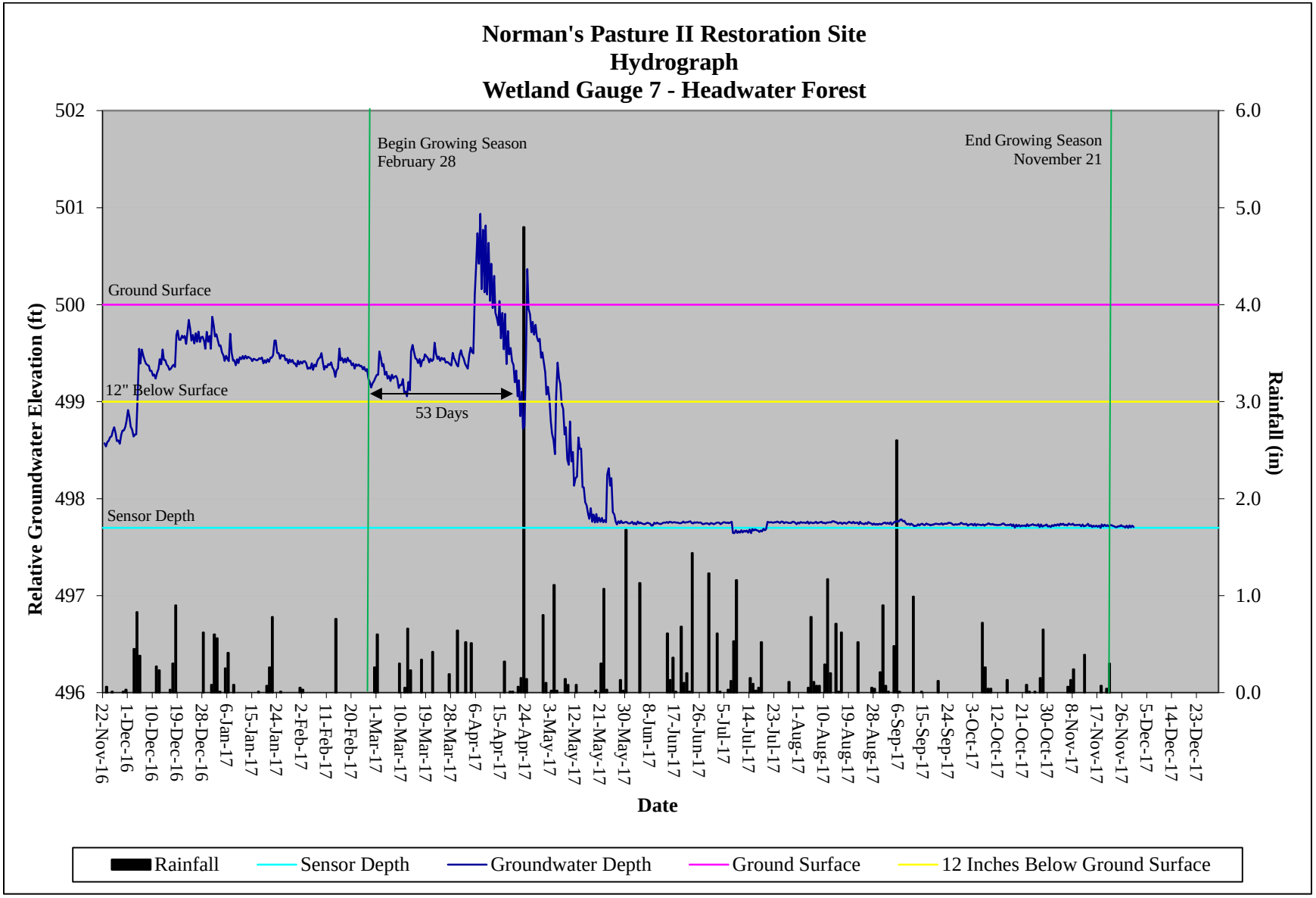

Norman's Pasture II Restoration Site
Hydrograph
Wetland Gauge 2 - Headwater Forest
Begin Growing Season
February 28
End Growing Season
November 21
Ground Surface
12" Below Surface
78 Days
Sensor Depth
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth

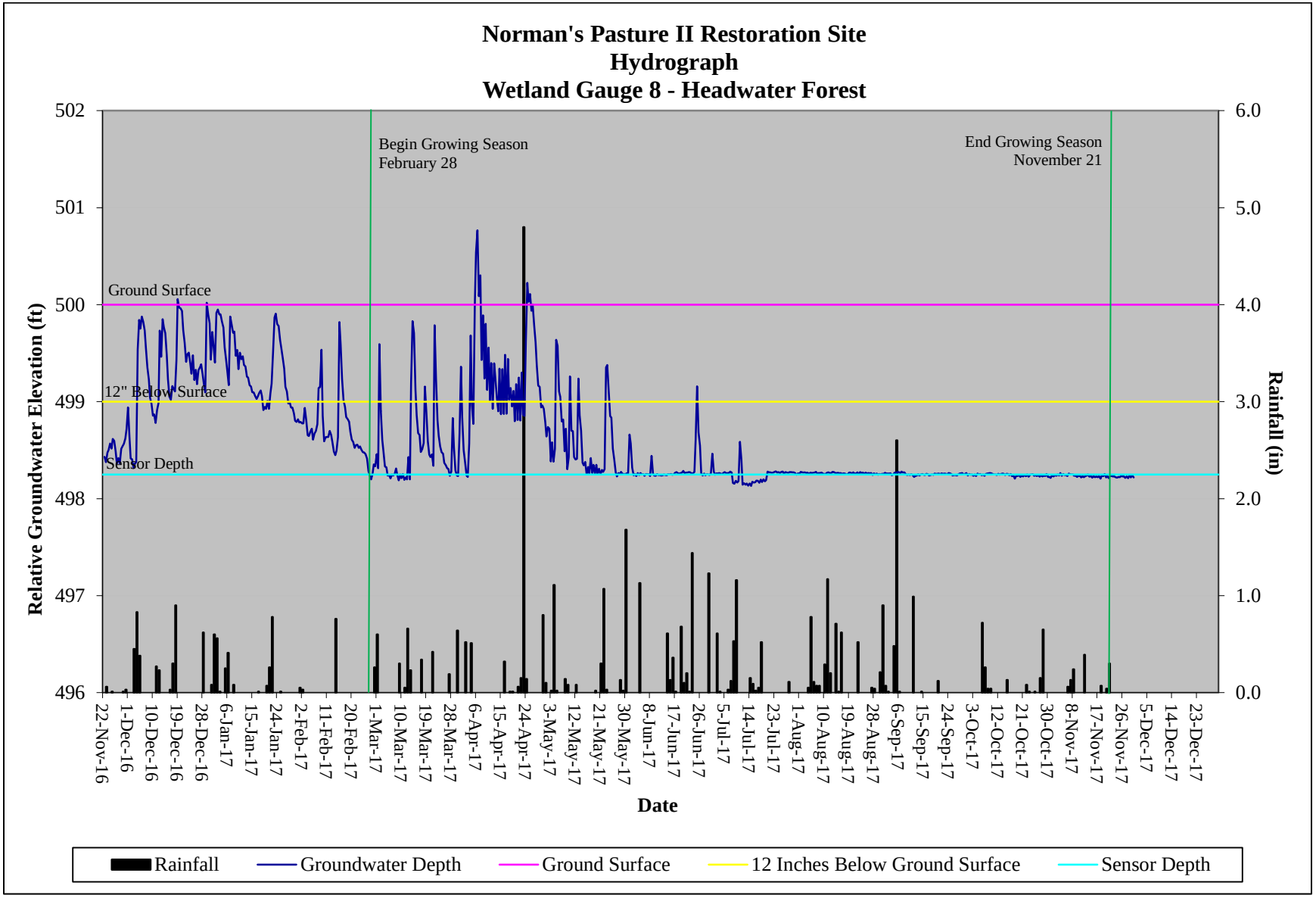

Norman's Pasture II Restoration Site
Hydrograph
Wetland Gauge 3 - Headwater Forest
Begin Growing Season
February 28
End Growing Season
November 21
Ground Surface
12" Below Surface
77 Days
Sensor Depth
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Sensor Depth
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface

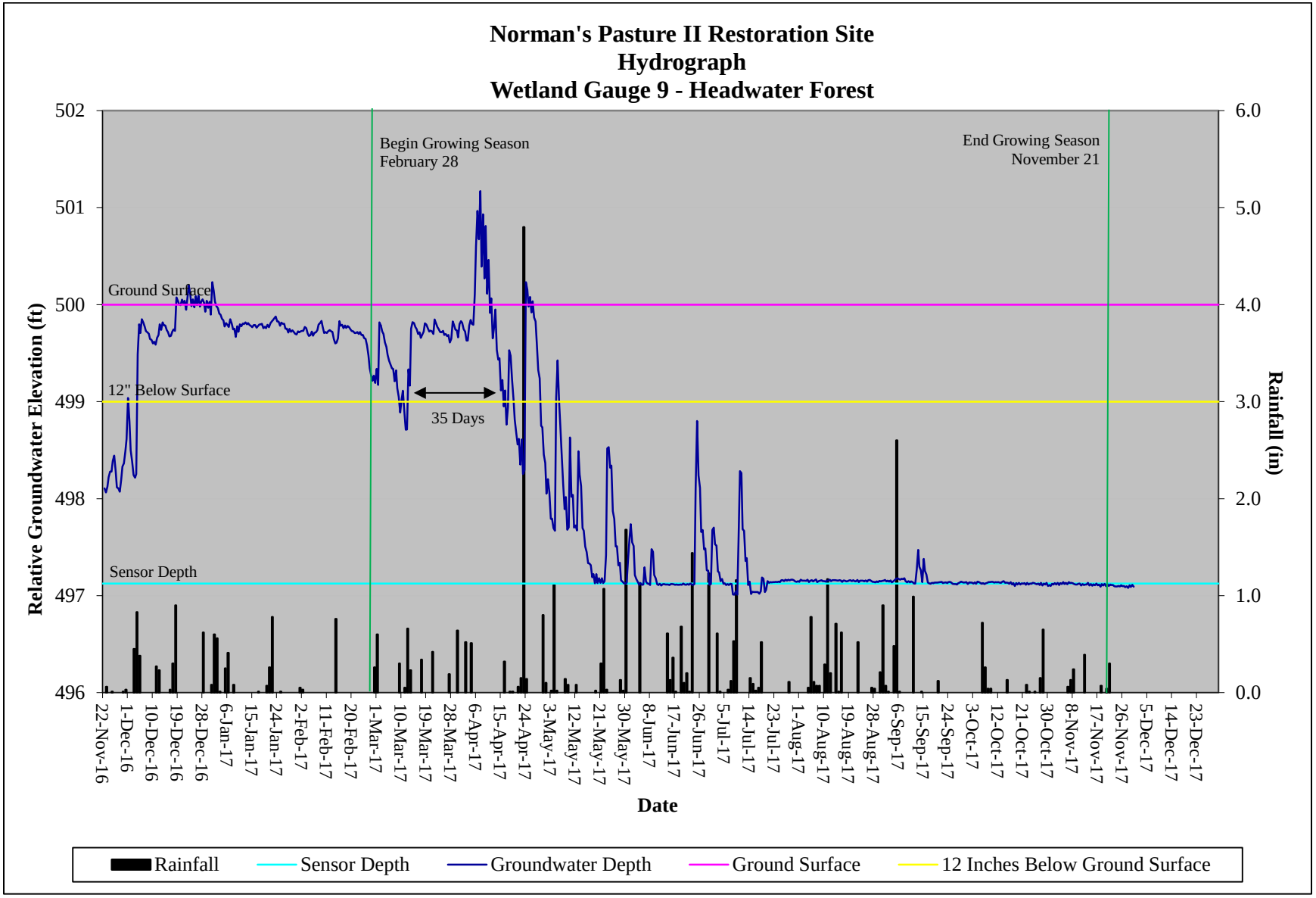

Norman's Pasture II Restoration Site
Hydrograph
Wetland Gauge 4 - Headwater Forest
Begin Growing Season
February 28
End Growing Season
November 21
Ground Surface
12" Below Surface
65 Days
Sensor Depth
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
502
501
500
499
498
497
496
6.0
5.0
4.0
3.0
2.0
1.0
0.0
22-Nov-16
1-Dec-16
10-Dec-16
19-Dec-16
28-Dec-16
6-Jan-17
15-Jan-17
24-Jan-17
2-Feb-17
11-Feb-17
20-Feb-17
1-Mar-17
10-Mar-17
19-Mar-17
28-Mar-17
6-Apr-17
15-Apr-17
24-Apr-17
3-May-17
12-May-17
21-May-17
30-May-17
8-Jun-17
17-Jun-17
26-Jun-17
5-Jul-17
14-Jul-17
23-Jul-17
1-Aug-17
10-Aug-17
19-Aug-17
28-Aug-17
6-Sep-17
15-Sep-17
24-Sep-17
3-Oct-17
12-Oct-17
21-Oct-17
30-Oct-17
8-Nov-17
17-Nov-17
26-Nov-17
5-Dec-17
14-Dec-17
23-Dec-17
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth

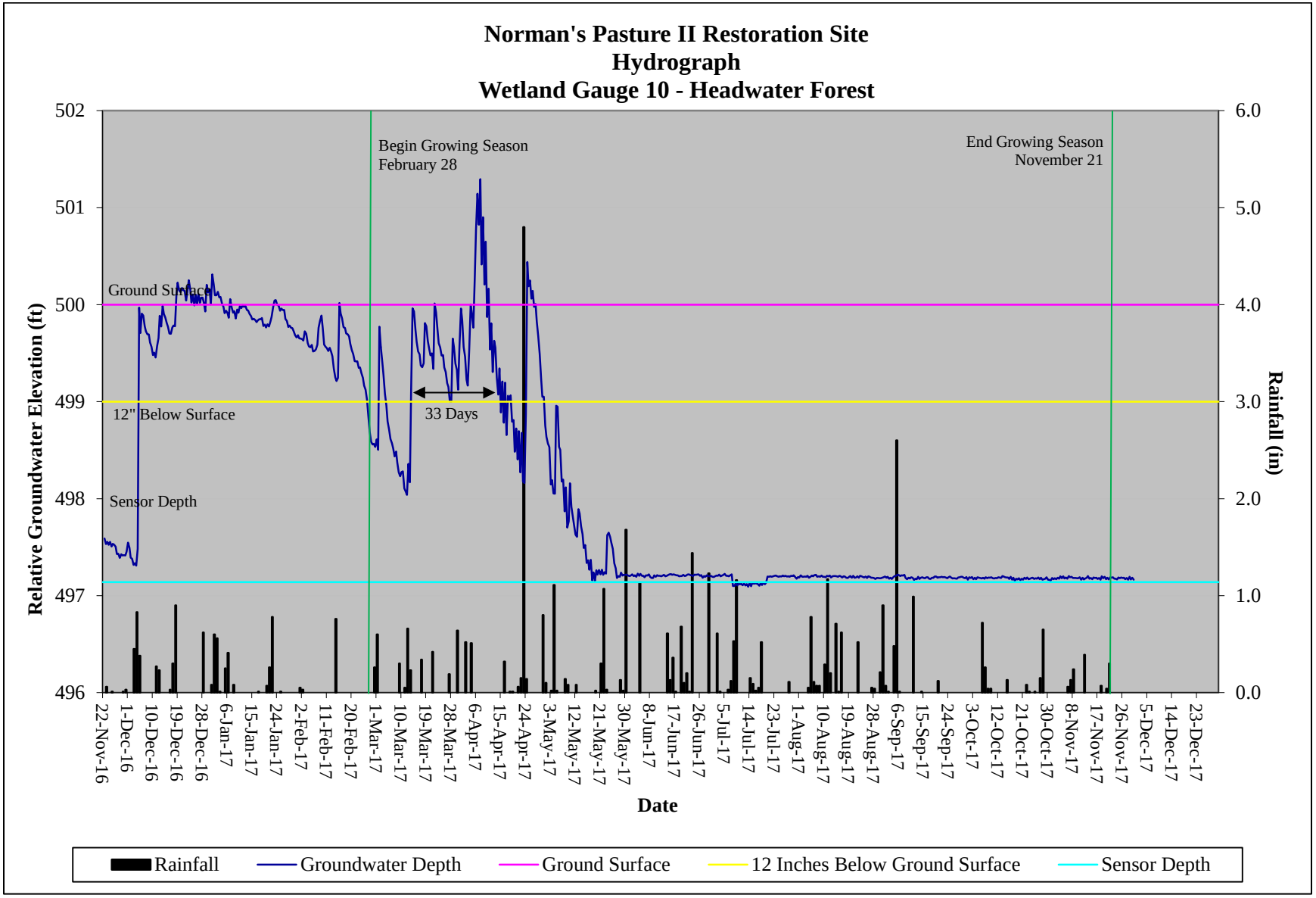

Norman's Pasture II Restoration Site
Hydrograph
Wetland Gauge 5 - Headwater Forest
Begin Growing Season
February 28
End Growing Season
November 21
Ground Surface
12" Below Surface
35 Days
Sensor Depth
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Sensor Depth
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface

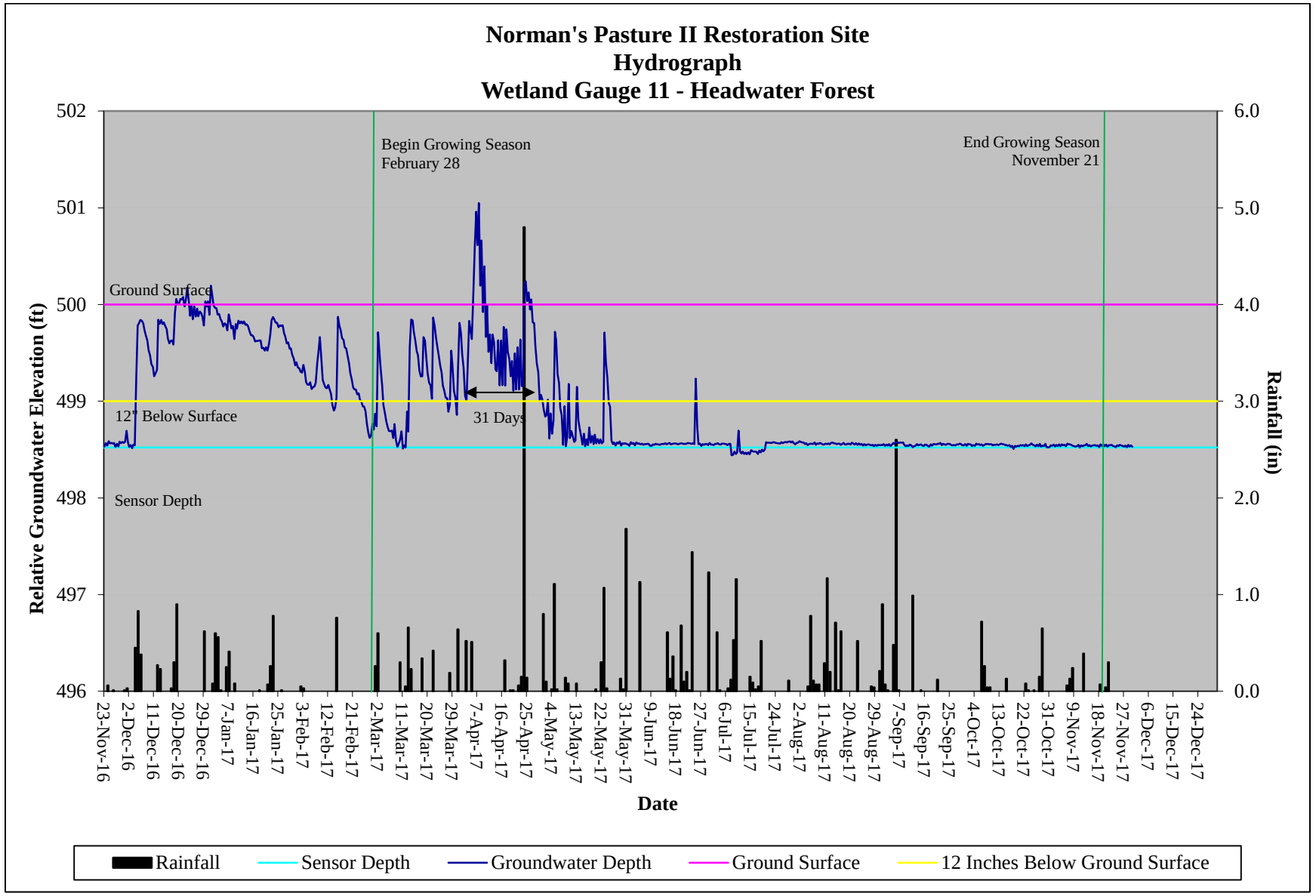

Norman's Pasture II Restoration Site
Hydrograph
Wetland Gauge 6 - Headwater Forest
Begin Growing Season
February 28
End Growing Season
November 21
Ground Surface
12" Below Surface
Sensor Depth
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth

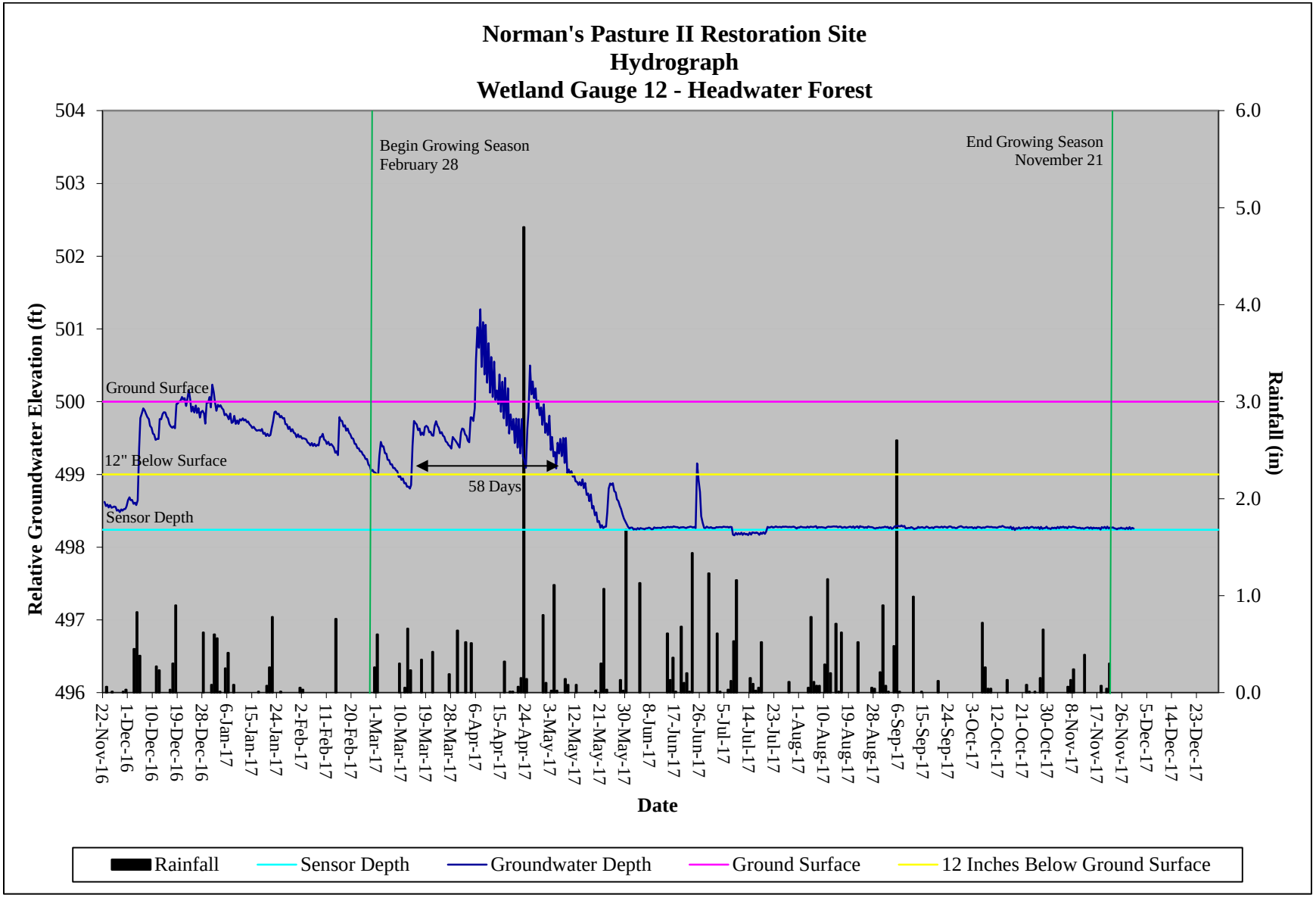

Norman's Pasture II Restoration Site
Hydrograph
Wetland Gauge 7 - Headwater Forest
Begin Growing Season
February 28
End Growing Season
November 21
Ground Surface
12" Below Surface
53 Days
Sensor Depth
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Sensor Depth
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface

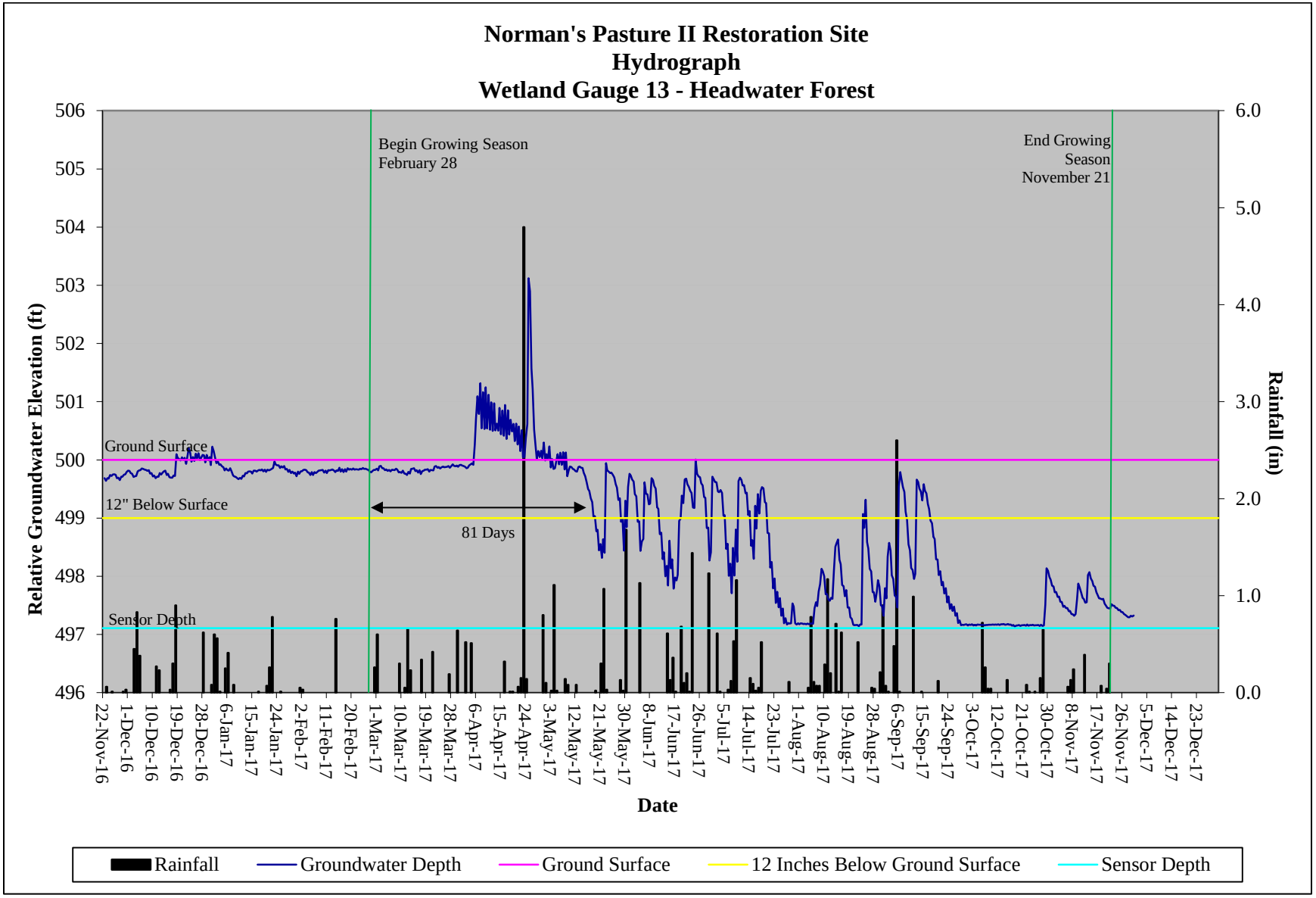

Norman's Pasture II Restoration Site
Hydrograph
Wetland Gauge 8 - Headwater Forest
Begin Growing Season
February 28
End Growing Season
November 21
Ground Surface
12" Below Surface
Sensor Depth
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth

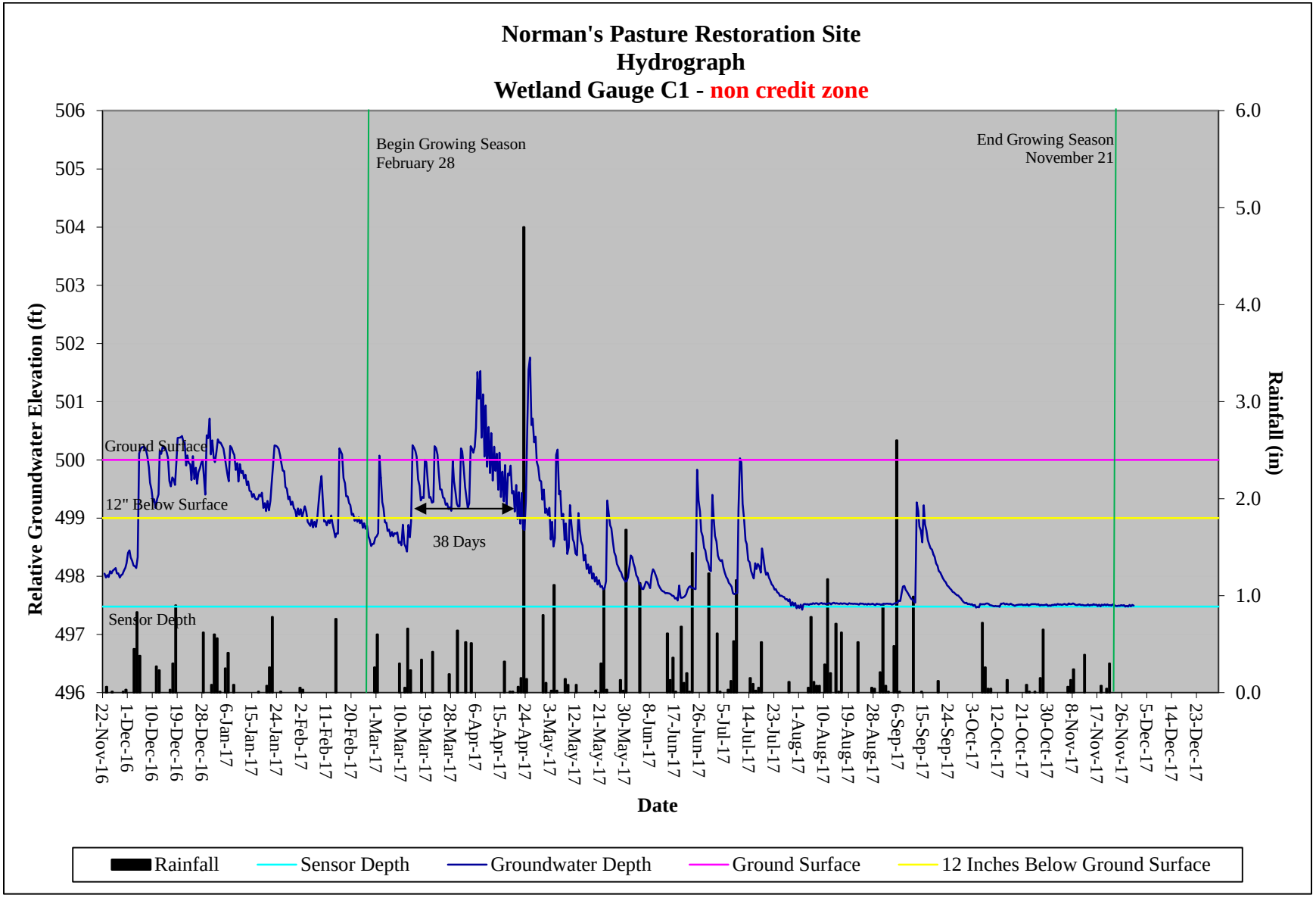

Norman's Pasture II Restoration Site
Hydrograph
Wetland Gauge 9 - Headwater Forest
Begin Growing Season
February 28
End Growing Season
November 21
Ground Surface
12" Below Surface
35 Days
Sensor Depth
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Sensor Depth
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface

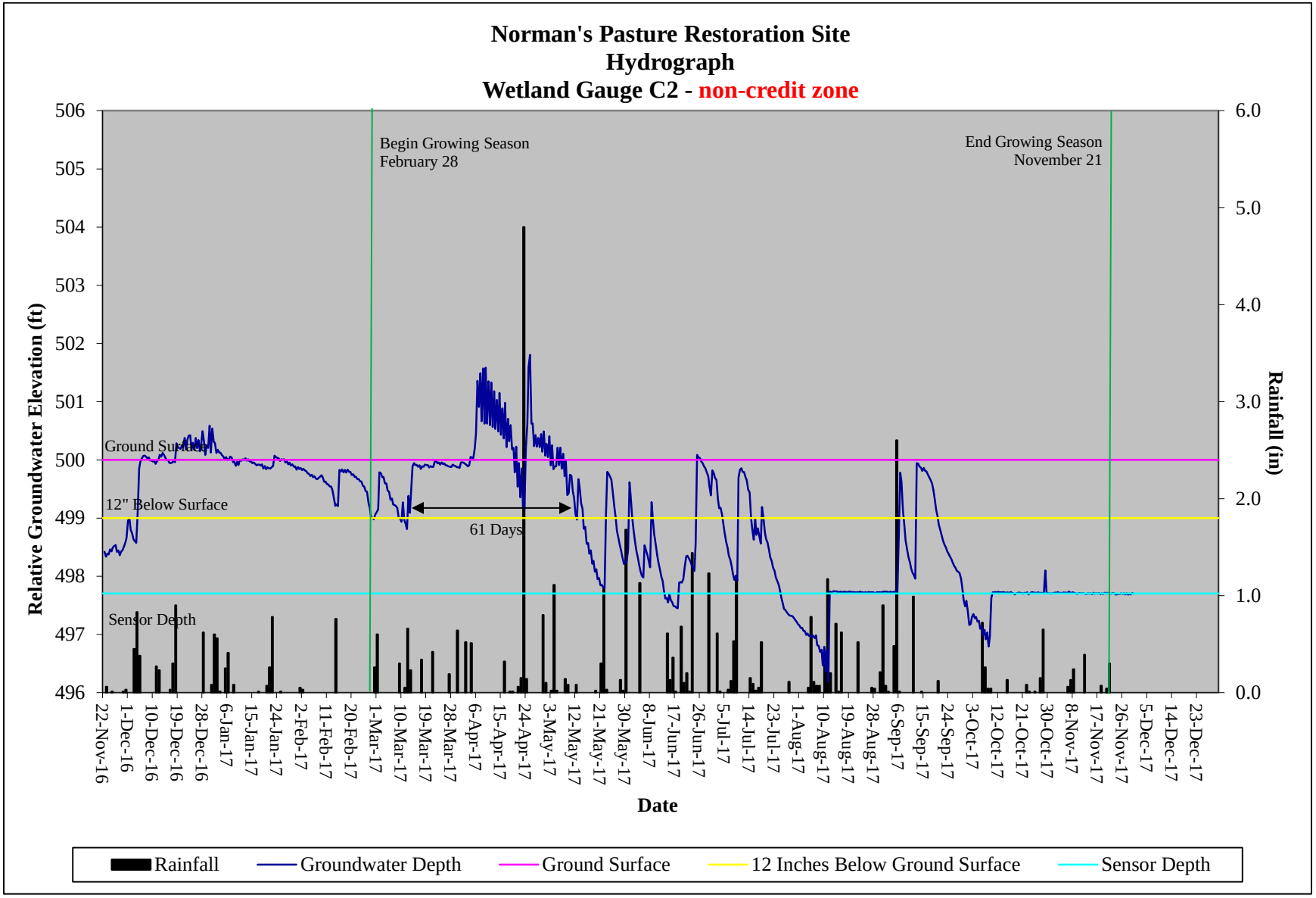

Norman's Pasture II Restoration Site
Hydrograph
Wetland Gauge 10 - Headwater Forest
Begin Growing Season
February 28
End Growing Season
November 21
Ground Surface
12" Below Surface
Sensor Depth
33 Days
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth


Norman's Pasture II Restoration Site
Hydrograph
Wetland Gauge 11 - Headwater Forest
Begin Growing Season
February 28
End Growing Season
November 21
Ground Surface
12" Below Surface
31 Days
Sensor Depth
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Sensor Depth
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface


Norman's Pasture II Restoration Site
Hydrograph
Wetland Gauge 12 - Headwater Forest
Begin Growing Season
February 28
End Growing Season
November 21
Ground Surface
12" Below Surface
Sensor Depth
58 Days
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Sensor Depth
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface


Norman's Pasture II Restoration Site
Hydrograph
Wetland Gauge 13 - Headwater Forest
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Begin Growing Season
February 28
End Growing
Season
November 21
Ground Surface
12" Below Surface
81 Days
Sensor Depth
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth


Norman's Pasture Restoration Site
Hydrograph
Wetland Gauge C1 - non credit zone
Begin Growing Season
February 28
End Growing Season
November 21
Ground Surface
12" Below Surface
38 Days
Sensor Depth
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Sensor Depth
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface


Norman's Pasture Restoration Site
Hydrograph
Wetland Gauge C2 - non-credit zone
Begin Growing Season
February 28
End Growing Season
November 21
Ground Surface
12" Below Surface
61 Days
Sensor Depth
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth