

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

USACE Action ID#: SWA-2013-00109
DWR Project #: 2014-0107
Sampson County, NC

Monitoring Year 06



Construction Completed: Feb 2016
Data Collection: 2021
Submitted: December 2021

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

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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 (NPPII) 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 NPPII also includes 0.8 acres of existing wetland preservation. The completed NPPII 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 NPPII 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 NPPII'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 NPPII 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 NPPII

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 monitoring gauge was installed in the stream on NPII to document the presence of surface water and record the occurrence of bankfull events. 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. Three more gauges were installed at NPII in February of 2018 and a fourth was installed in March 2019, for a total of 26 wetland hydrology gauges within the credit bearing portions of the site. 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.

Wetland hydrology is monitored with the series of 26 automatic gauges described above that record water table depth. Two additional gauges are 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. Over the course of monitoring, one gauge (NPII-8) has not achieved the success criteria in any of the monitoring years. On January 29, 2021, KCI performed a detailed investigation of the vegetation, soils, and visual hydrology indicators around this gauge. As a result of this investigation, 0.067 acres of wetland reestablishment have been designated as "at-risk." Please see the Current Conditions Plan View for more information.

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. No vegetation monitoring occurred during the sixth monitoring year, as stipulated in the Mitigation Plan.

2.2 Hydrology Monitoring Results

Twenty-two groundwater monitoring gauges were installed at baseline 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. Three more gauges were installed at NPII in February of 2018. Another gauge was installed in March 2019 and a final gauge was installed in November 2020, bringing the total number of credit bearing gauges to 27. The growing season for Sampson County 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 "Assessing 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 2021 year, the months of January, February, and July experienced above average rainfall, March, June, August experienced average rainfall. The months of April, May, September, October, and November recorded below average rainfall for the site. Overall, the area experienced average rainfall during the 2021 growing season.

During the site's sixth growing season, twenty-four of the twenty-seven 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). All three of the gauges that did not meet the success criteria are located on the Norman's II site. One of these gauges (NPII-8) has not met the success criteria in any of the monitoring year and is within the area designated as "at-risk." Another of the gauges that did not meet this year (NPII-6) has only met the success criteria in 2 out of the 6 monitoring years. This gauge has achieved better than jurisdictional hydrology (5%) in 2 of its 4 unsuccessful years. It achieved continuous saturation for 22 days (8.2%) in MY04 and for 20 days (7.5%) in the current monitoring year. The final gauge that did not meet the success criteria was NPII-18. This gauge was installed in November 2020 to evaluate the area around NPII-6. In MY06 this gauge achieved continuous saturation for 22 days (8.2%). NPII-14 was also installed to evaluate the area around NPII-6. This gauge is located approximately 50 feet northwest of NPII-6 and 30 feet west of NPII-18 and has achieved the success criteria in all 4 years since it was installed. The success of this gauge, as well as the fact that NPII-6 and NPII-18 have achieved greater than jurisdictional hydrology in more than 50% of their time recording indicates that NPII-6 and NPII-18 are located in the transition zone between the higher functioning wetlands and the upland areas

outside of the easement. Both NPII-6 and NPII-18 are located within about 30 feet of the easement boundary and so it is unsurprising that the area around them would be transitional. Although the hydrology in this area has been less than the success criteria that is to be expected, this area has not been designated as “at-risk” in the same way as the area around NPII-8 because of these mitigating factors. Please refer to Table 8 in Appendix D for gauge data.

As part of the site success criteria the stream must experience two bankfull events in separate years. The stream experienced several bankfull events in all six monitoring years, including three in 2021, and has met this criteria. See Table 7 in Appendix D.

2.3 Visual Monitoring Results

A yearly visual assessment of the enhanced stream on NPII will occur every year. The sixth 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.

In December 2020 Chinese privet (*Ligustrum sinense*) growing on-site was treated with herbicide application. The majority of this privet was growing in areas where mature trees were left intact during construction, especially along the site’s boundary with Stewart’s Creek and along the edges of the stream enhancement area. This treatment was repeated in August 2021. Please see Appendix B – Visual Assessment Data for more information.

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.
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- Sprecher, S. W., and Warne, A. G. (2000). “Assessing 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.
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https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/north_carolina/NC163/0/sampson.pdf

Appendix A

Project Vicinity Map and Background Tables

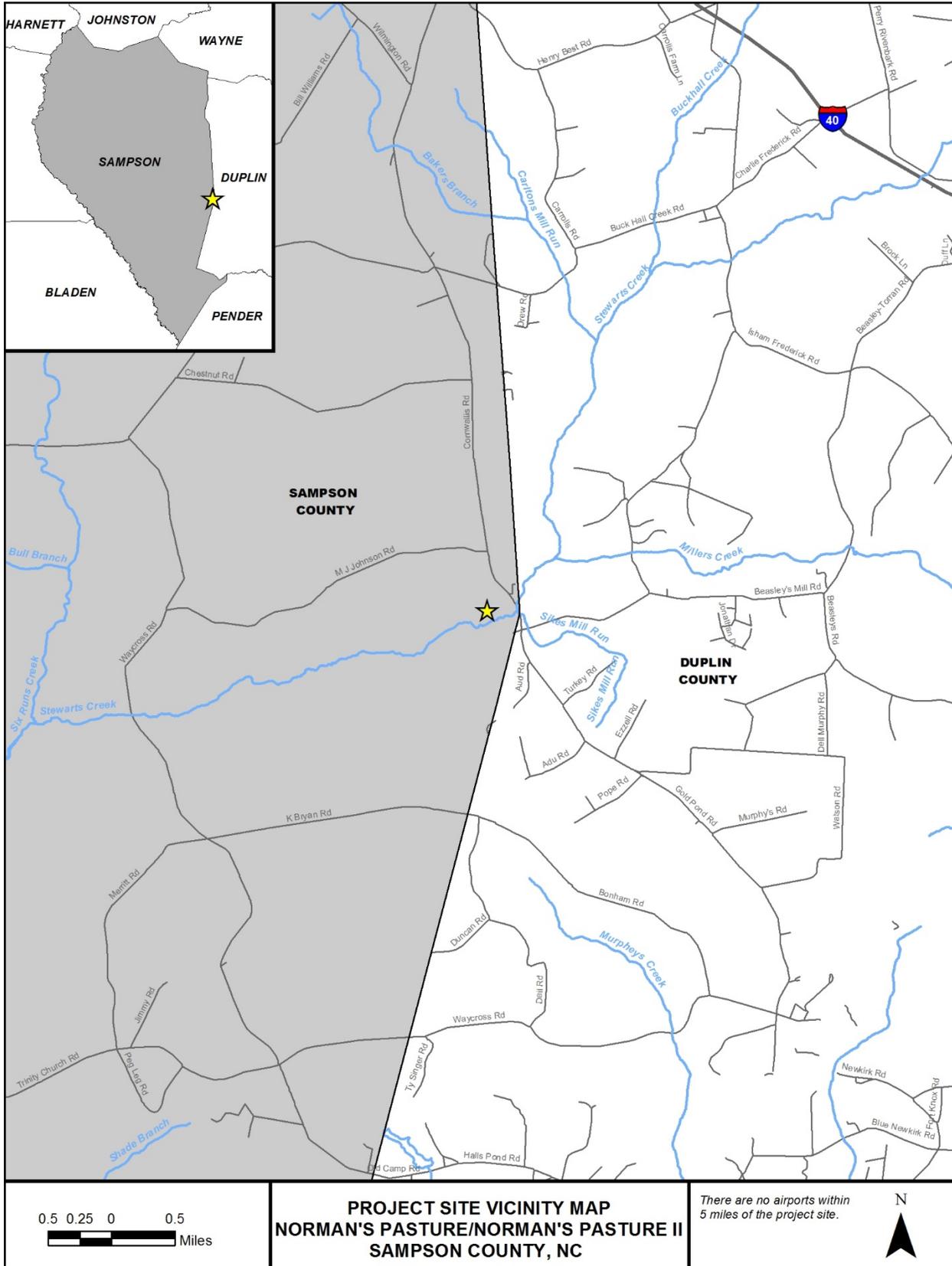


Table 1a. Project Components and Mitigation Credits									
Norman's Pasture Restoration Site, DMS Project #95717									
Mitigation Credits									
	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Length			16.2						
Credits			15.97						
TOTAL CREDITS			15.97						
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			15.97						

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		337.2	9.73						
TOTAL CREDITS	337.2		9.73						
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				10.2					
Enhancement									
Enhancement I									
Enhancement II	843								
Creation									
Preservation									
High Quality Preservation									
TOTAL CREDITS	337.2			9.73					

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	
Year 3 Monitoring	Dec 2018	Dec 2018
Vegetation Monitoring	July 11, 2018	
Photo Points	Dec 5, 2018	
Gauge Downloads	Nov 12, 2018	
Year 4 Monitoring	Nov 2019	Dec 2019
Vegetation Monitoring	N/A	
Photo Points	Nov 13, 2019	
Gauge Downloads	Nov 13, 2019	
Invasive Treatment		Dec 3, 2020
Year 5 Monitoring	Nov 2020	Dec 2020
Vegetation Monitoring	July 27, 2020	
Photo Points	Nov 20, 2020	
Gauge Downloads	Nov 20, 2020	
Invasive Treatment		Aug 20, 2021
Year 6 Monitoring	Nov 2021	Dec 2021
Photo Points	Sept 17, 2021	
Gauge Downloads	Nov 19, 2021	

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	
	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 Summary 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 Summary 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%	0%

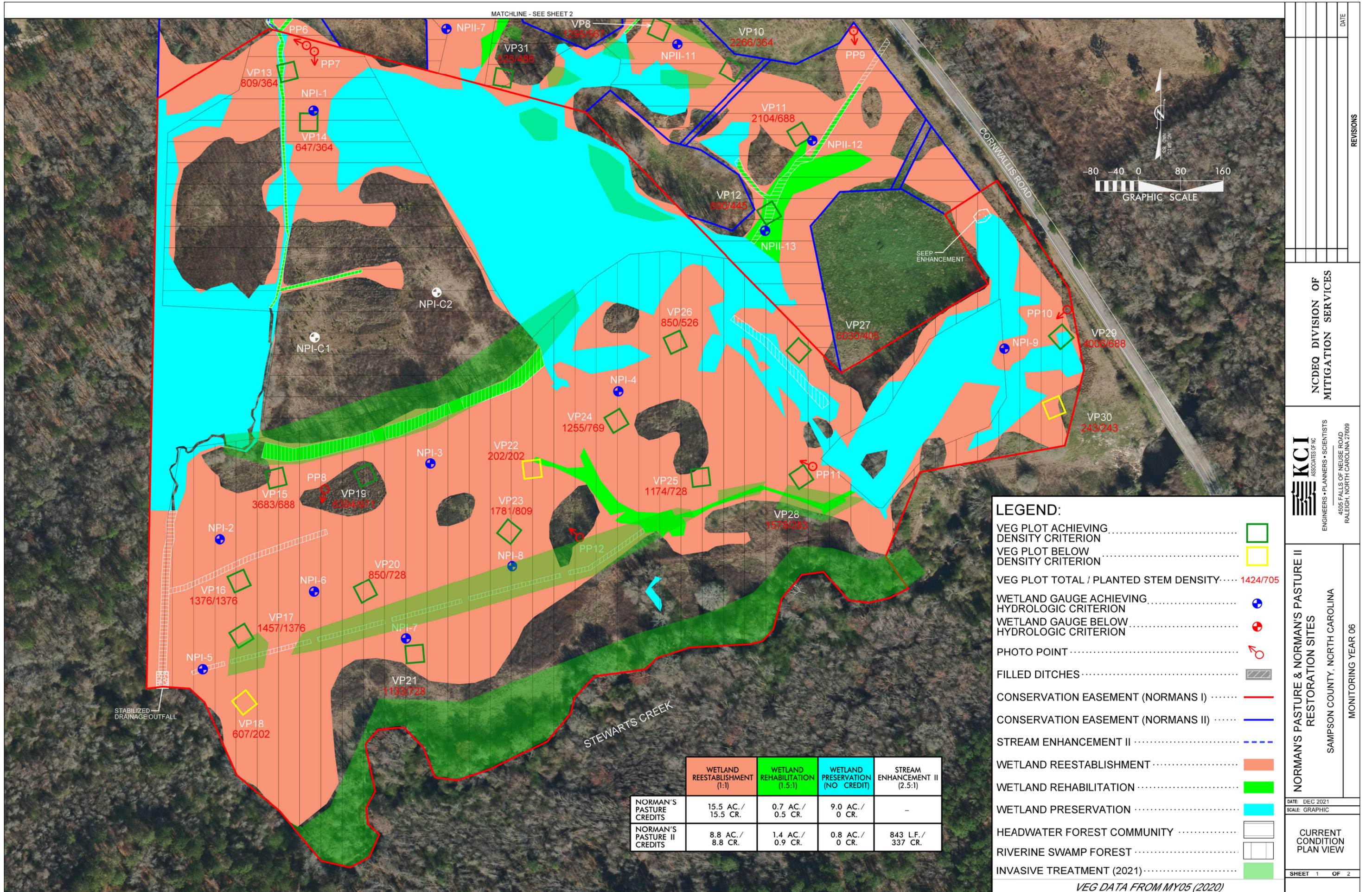
Project Information continued - Norman's II Restoration Site Restoration Site

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



NO.	DATE	REVISIONS

NCDEQ DIVISION OF
MITIGATION SERVICES

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

NORMAN'S PASTURE & NORMAN'S PASTURE II
RESTORATION SITES
SAMPSON COUNTY, NORTH CAROLINA
MONITORING YEAR 06

DATE: DEC 2021
SCALE: GRAPHIC

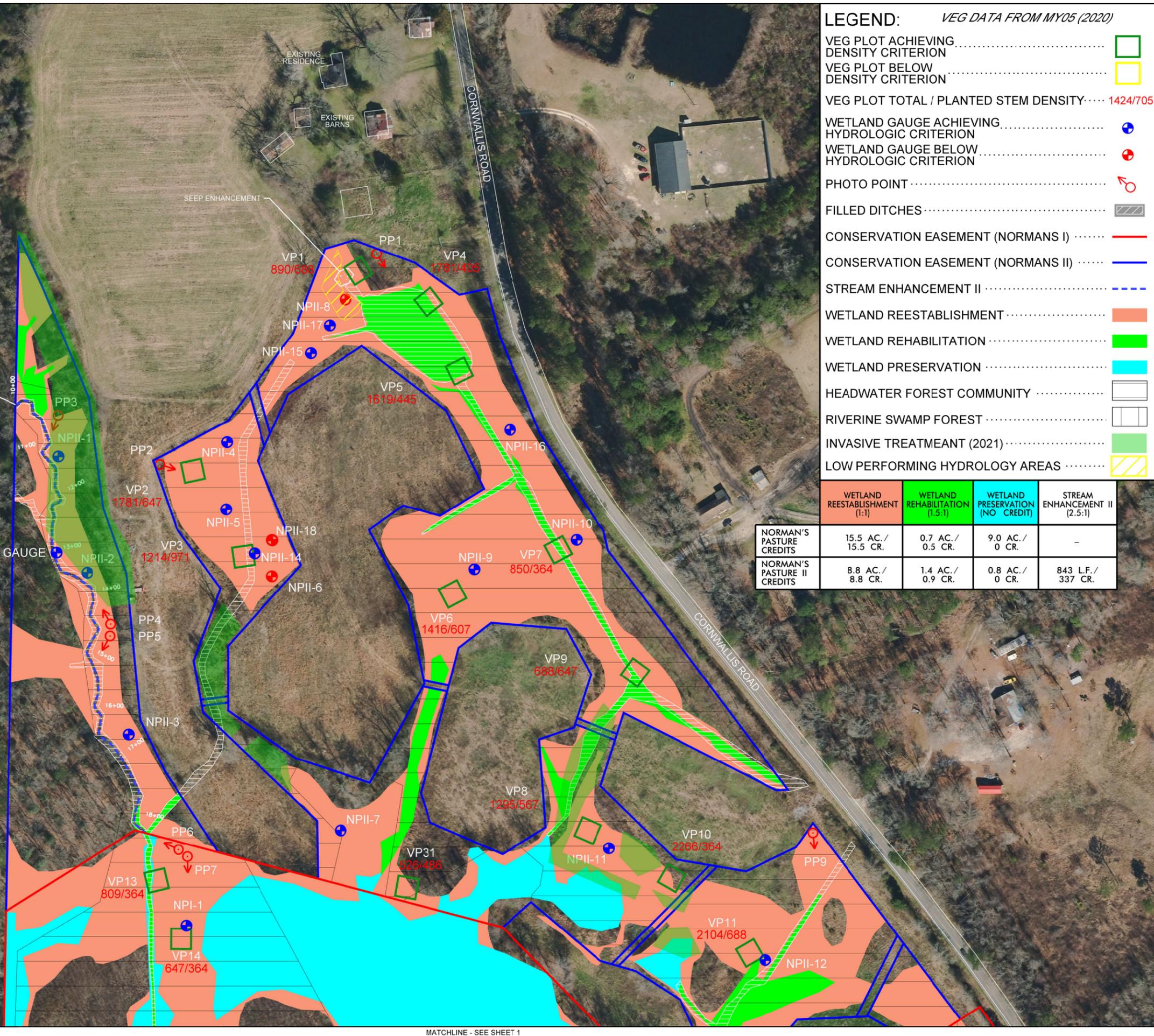
CURRENT
CONDITION
PLAN VIEW

SHEET 1 OF 2

LEGEND:

- VEG PLOT ACHIEVING DENSITY CRITERION
- VEG PLOT BELOW DENSITY CRITERION
- VEG PLOT TOTAL / PLANTED STEM DENSITY 1424/705
- 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
- INVASIVE TREATMENT (2021)

	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 DATA FROM MY05 (2020)*
- VEG PLOT ACHIEVING DENSITY CRITERION
 - VEG PLOT BELOW DENSITY CRITERION
 - VEG PLOT TOTAL / PLANTED STEM DENSITY 1424/705
 - 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
 - INVASIVE TREATMENT (2021)
 - LOW PERFORMING HYDROLOGY AREAS

	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.

	DATE
REVISIONS	
NCDEQ DIVISION OF MITIGATION SERVICES	
KCI <small>ASSOCIATES OF NC</small> ENGINEERS • PLANNERS • SCIENTISTS 4505 FALLS OF NEUSE ROAD RALEIGH, NORTH CAROLINA 27609	
NORMAN'S PASTURE & NORMAN'S PASTURE II RESTORATION SITES SAMPSON COUNTY, NORTH CAROLINA MONITORING YEAR 06	
DATE: DEC 2021	
SCALE: GRAPHIC	
CURRENT CONDITION PLAN VIEW	
SHEET 2 OF 2	

MATCHLINE - SEE SHEET 1

Table 5. 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. Invasive Treatment Area	Areas or points (if too small to render as polygons at map scale).	1,000 SF	Pattern and Color	14	7.10	19.2%
6. 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 Points



PP01 – MY-00 – 4/15/16



PP01 – MY-06 – 9/17/21



PP02 – MY-00 – 4/15/16



PP02 – MY-06 – 9/17/21



PP03 – MY-00 – 4/15/16



PP03 – MY-06 – 9/17/21



PP04 – MY-00 – 4/15/16



PP04 – MY-06 – 9/17/21



PP05 – MY-00 – 4/15/16



PP05 – MY-06 – 9/17/21



PP06 – MY-00 – 4/15/16



PP06 – MY-06 – 9/17/21



PP07 – MY-00 – 4/15/16



PP07 – MY-06 – 9/17/21



PP08 – MY-00 – 4/15/16



PP08 – MY-06 – 9/17/21



PP09 – MY-00 – 4/15/16



PP09 – MY-06 – 9/17/21



PP10 – MY-00 – 4/15/16



PP10 – MY-06 – 9/17/21



PP11 – MY-00 – 4/15/16



PP11 – MY-06 – 9/17/21



PP12 – MY-00 – 4/15/16



PP12 – MY-06 – 9/17/21

Appendix C

Vegetation Plot Data

Table 6: CVS Stem Count Total and Planted by Plot and Species, Norman's Pasture and Norman's Pasture II Restoration Sites																	
DMS Project #: 95717/96310			Annual Means														
Scientific Name	Common Name	Species Type	MY5 (2020)			MY3 (2018)			MY2 (2017)			MY1 (2016)			MY0 (2016)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
<i>Acer rubrum</i>	red maple	Tree			355			241			178			92			
<i>Alnus serrulata</i>	hazel alder	Shrub						84			13			4			
<i>Baccharis halimifolia</i>	eastern baccharis	Shrub						20			16			2			
<i>Betula nigra</i>	river birch	Tree	47	47	54	47	47	80	48	48	83	47	47	61	42	42	42
<i>Cephalanthus occidentalis</i>	common buttonbush	Shrub	27	27	29	31	31	31	31	31	31	21	21	21			
<i>Cornus amomum</i>	silky dogwood	Shrub										2	2	2			
<i>Corylus americana</i>	American hazelnut	Shrub										4	4	4			
<i>Crataegus phaenopyrum</i>	Washington hawthorn	Shrub Tree			3			6			6			1			
<i>Diospyros virginiana</i>	common persimmon	Tree	3	3	36	3	3	29	3	3	32						
<i>Fraxinus pennsylvanica</i>	green ash	Tree	33	33	35	33	33	35	32	32	34	30	30	31	36	36	36
<i>Juglans nigra</i>	black walnut	Tree	2	2	3	2	2	5	2	2	9	2	2	5			
<i>Liquidambar styraciflua</i>	sweetgum	Tree			102			35			42			29			
<i>Liriodendron tulipifera</i>	tuliptree	Tree	6	6	15	17	17	24	18	18	22	19	19	21	10	10	10
<i>Morella cerifera</i>	wax myrtle	shrub						3			2			1			
<i>Nyssa aquatica</i>	water tupelo	Tree	42	42	42	62	62	62	75	75	75	79	79	79	60	60	60
<i>Nyssa biflora</i>	swamp tupelo	Tree	1	1	1	2	2	2	2	2	2	2	2	2			
<i>Pinus taeda</i>	loblolly pine	Tree			26			23			6						
<i>Platanus occidentalis</i>	American sycamore	Tree			2												
<i>Prunus serotina</i>	black cherry	Tree						2			2			1			
<i>Quercus laurifolia</i>	laurel oak	Tree	36	36	36	57	57	57	64	64	64	70	70	70	68	68	68
<i>Quercus lyrata</i>	overcup oak	Tree	54	54	54	59	59	60	63	63	64	65	65	65	33	33	33
<i>Quercus michauxii</i>	swamp chestnut oak	Tree	44	44	45	52	52	52	59	59	59	60	60	60	42	42	42
<i>Quercus nigra</i>	water oak	Tree			1												
<i>Quercus phellos</i>	willow oak	Tree	2	2	11	2	2	2	2	2	2	3	3	3	1	1	1
<i>Quercus rubra</i>	northern red oak	Tree			112												
<i>Rhus copallinum</i>	flameleaf sumac	shrub						10			18			5			
<i>Salix nigra</i>	black willow	Tree			16			38			49			26			
<i>Taxodium distichum</i>	bald cypress	Tree	166	166	168	171	171	171	173	173	173	171	171	171	169	169	169
<i>Ulmus americana</i>	American elm	Tree			9			9			6			6			
Unknown		Shrub or Tree	1	1	115	2	2	2	4	4	4	21	21	35	213	213	213
	Stem count		464	464	1270	540	540	1083	576	576	992	596	596	797	674	674	674
	size (ares)		31			31			31			31			31		
	size (ACRES)		0.766			0.766			0.766			0.766			0.766		
	Species count		14	14	23	14	14	25	14	14	25	15	15	25	10	10	10
	Stems per ACRE		606	606	1658	705	705	1414	752	752	1295	778	778	1040	880	880	880

Appendix D

Hydrologic Data

Norman's Pasture II Restoration Site Hydrograph Stream Gauge

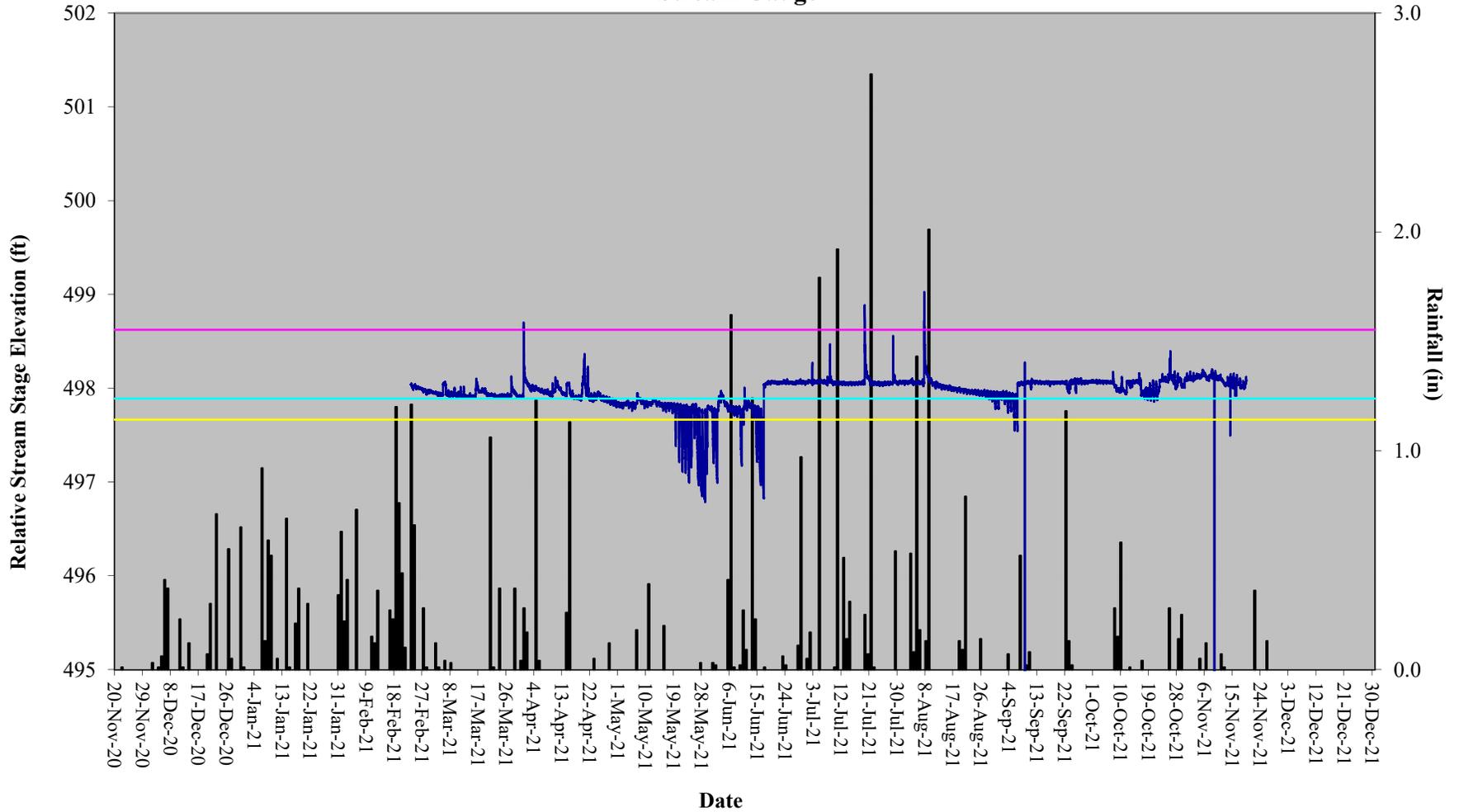


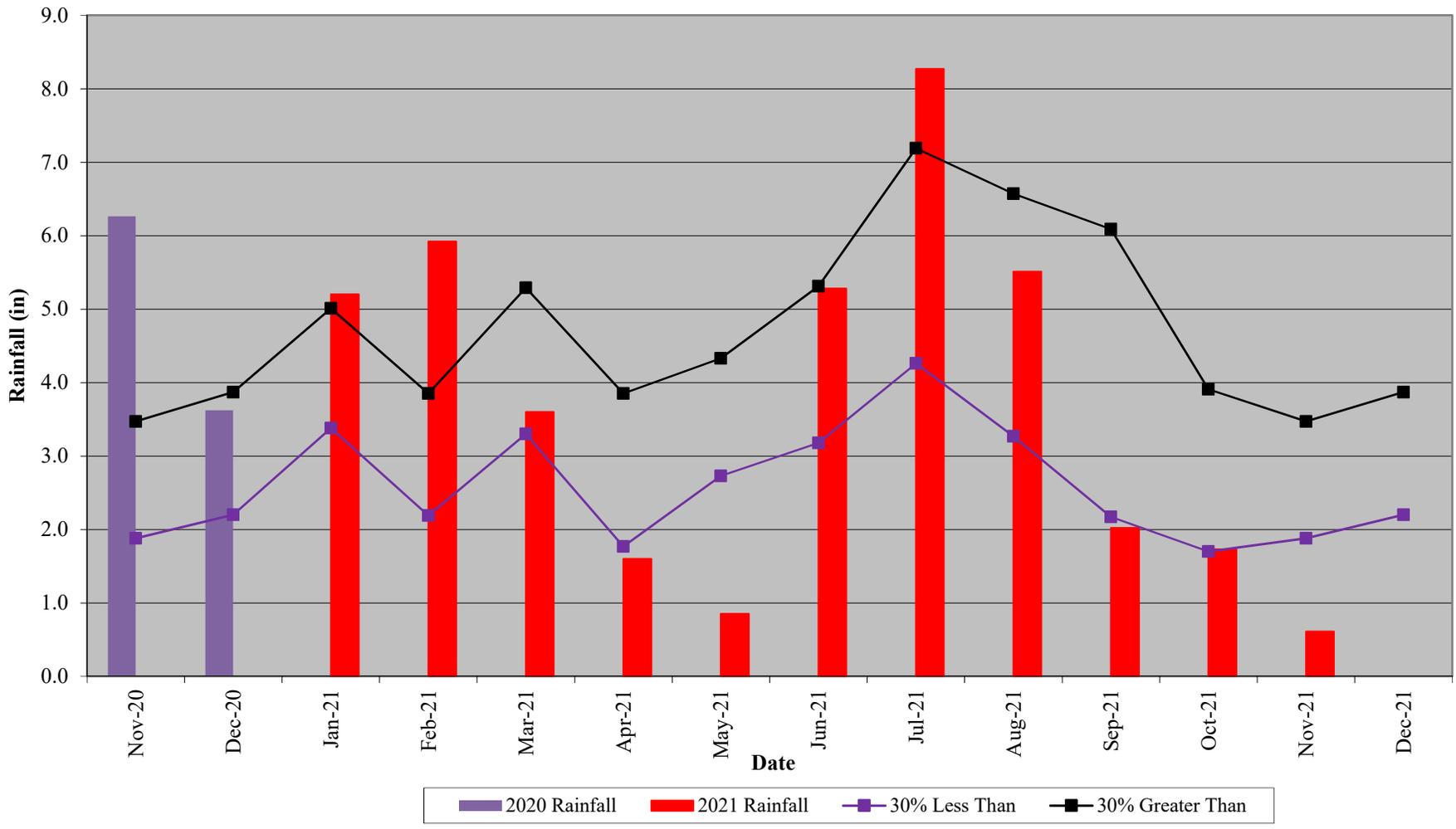
Table 7. Verification of Bankfull Events**Norman's Pasture and Norman's Pasture II Restoration Sites, DMS Project Number 95717/96310**

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
8/20/2018	8/20/2018	On-site automatic gauge	N/A
9/16/2018	9/16/2018	On-site automatic gauge	N/A
4/13/2019	4/13/2019	On-site automatic gauge	N/A
2/7/2020	2/7/2020	On-site automatic gauge	N/A
8/14/2020	8/14/2020	On-site automatic gauge	N/A
3/31/2021	3/31/2021	On-site automatic gauge	N/A
7/19/2021	7/19/2021	On-site automatic gauge	N/A
8/7/2021	8/7/2021	On-site automatic gauge	N/A

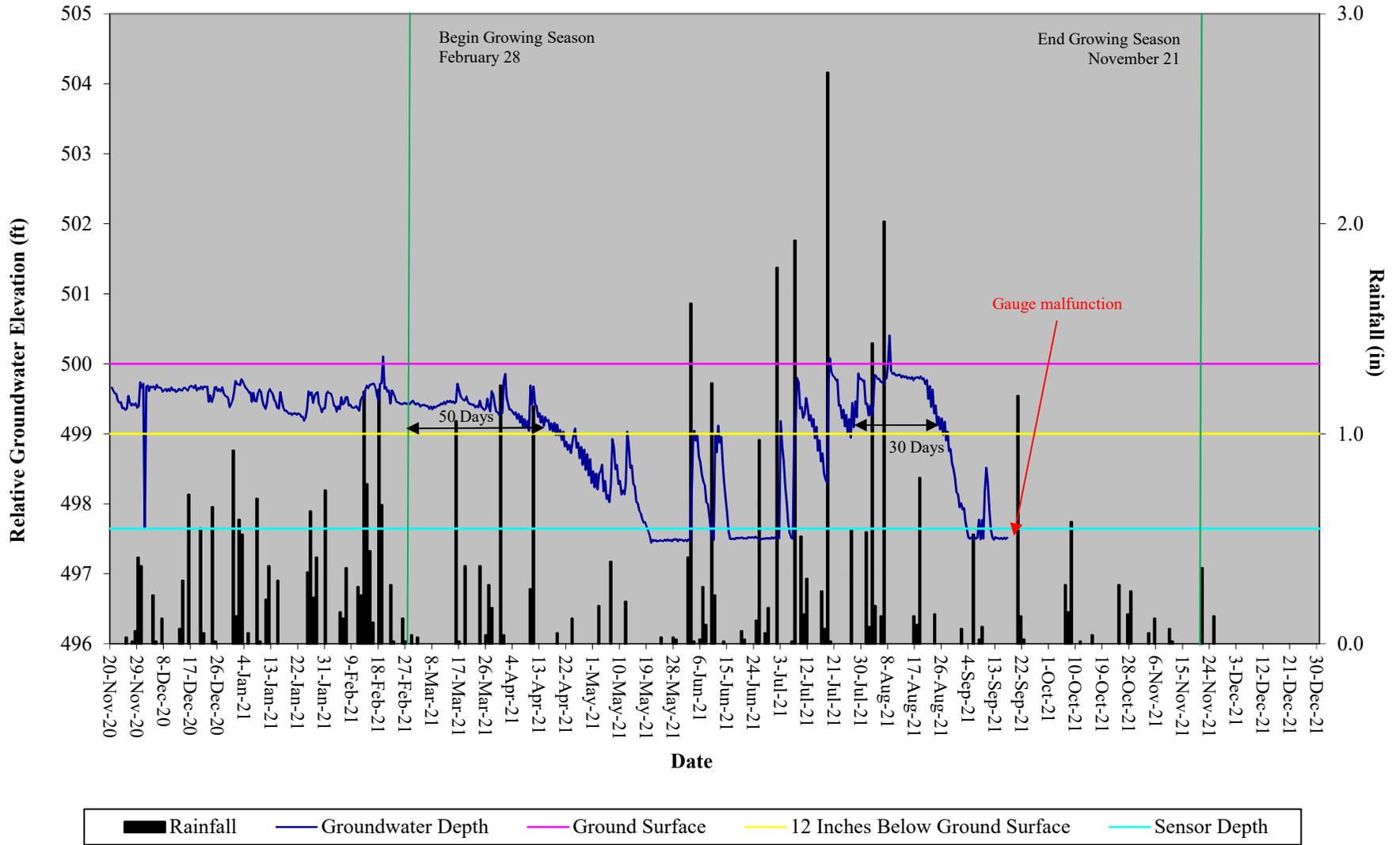
Table 8. Wetland Hydrology Criteria Attainment
Norman's Pasture and Norman's Pasture II Restoration Sites, DMS Project Number 95717/96310

Gauge	Location	MY1 (2016)	MY2 (2017)	MY3 (2018)	MY4 (2019)	MY5 (2020)	MY6 (2021)	MY7 (2022)
NP1	Headwater Forest	Yes/111 (41.6%)	Yes/91 (34.1%)	Yes/106 (39.7%)	Yes/59 (22.1%)	Yes/73 (27.3%)	Yes/50 (18.7%)	
NP2	Riverine Swamp Forest	Yes/98 (36.7%)	Yes/84 (31.5%)	Yes/73 (27.3%)	Yes/71 (26.6%)	Yes/80 (30.0%)	Yes/80 (30.0%)	
NP3	Riverine Swamp Forest	Yes/99 (37.1%)	Yes/106 (39.7%)	Yes/106 (39.7%)	Yes/73 (27.3%)	Yes/101 (37.8%)	Yes/77 (28.8%)	
NP4	Riverine Swamp Forest	Yes/81 (30.3%)	Yes/105 (39.3%)	Yes/105 (39.3%)	Yes/77 (28.8%)	Yes/176 (65.9%)	Yes/109 (40.8%)	
NP5	Riverine Swamp Forest	Yes/64 (24.0%)	Yes/41 (15.4%)	Yes/67 (25.1%)	Yes/62 (23.2%)	Yes/71 (26.6%)	Yes/78 (29.2%)	
NP6	Riverine Swamp Forest	Yes/100 (37.5%)	Yes/103 (38.6%)	Yes/106 (39.7%)	Yes/76 (28.5%)	Yes/121 (45.3%)	Yes/83 (31.1%)	
NP7	Riverine Swamp Forest	Yes/64 (24.0%)	Yes/77 (28.8%)	Yes/60 (22.5%)	Yes/60 (22.5%)	Yes/71 (26.6%)	Yes/67 (25.1%)	
NP8	Riverine Swamp Forest	No/30 (11.2%)	Yes/58 (21.7%)	Yes/36 (13.5%)	Yes/59 (22.1%)	Yes/71 (26.6%)	Yes/61 (22.8%)	
NP9	Riverine Swamp Forest	Yes/39 (14.6%)	Yes/59 (22.1%)	Yes/35 (13.1%)	Yes/61 (22.8%)	Yes/101 (37.8%)	Yes/76 (28.5%)	
NPII 1	Headwater Forest	Yes/65 (24.3%)	Yes/77 (28.8%)	Yes/66 (24.7%)	Yes/64 (24.0%)	Yes/55 (20.6%)	Yes/53 (19.9%)	
NPII 2	Headwater Forest	Yes/81 (30.3%)	Yes/78 (29.2%)	Yes/65 (24.3%)	Yes/33 (12.4%)	Yes/41 (15.4%)	Yes/49 (18.4%)	
NPII 3	Headwater Forest	Yes/50 (18.7%)	Yes/77 (28.8%)	Yes/51 (19.1%)	Yes/39 (14.6%)	Yes/45 (16.9%)	Yes/50 (18.7%)	
NPII 4	Headwater Forest	Yes/64 (24.0%)	Yes/65 (24.3%)	Yes/65 (24.3%)	Yes/59 (22.1%)	Yes/60 (22.5%)	Yes/52 (19.5%)	
NPII 5	Headwater Forest	No/22 (8.2%)	Yes/35 (13.1%)	Yes/36 (13.5%)	Yes/58 (21.7%)	Yes/51 (19.1%)	Yes/41 (15.4%)	
NPII 6	Headwater Forest	No/6 (2.2%)	No/7 (2.6%)	Yes/33 (12.4%)	No/22 (8.2%)	Yes/37 (13.9%)	No/20 (7.5%)	
NPII 7	Headwater Forest	Yes/29 (10.9%)	Yes/53 (19.9%)	Yes/35 (13.1%)	Yes/57 (21.3%)	Yes/37 (13.9%)	Yes/51 (19.1%)	
NPII 8	Headwater Forest	No/12 (4.5%)	No/7 (2.6%)	No/18 (6.7%)	No/14 (5.2%)	No/22 (8.2%)	No/21 (7.9%)	
NPII 9	Headwater Forest	No/18 (6.7%)	Yes/35 (13.1%)	Yes/37 (13.9%)	Yes/50 (18.7%)	Yes/44 (16.5%)	Yes/40 (15.0%)	
NPII 10	Headwater Forest	No/18 (6.7%)	Yes/33 (12.4%)	Yes/35 (13.1%)	Yes/33 (12.4%)	Yes/38 (14.2%)	Yes/41 (15.4%)	
NPII 11	Headwater Forest	No/9 (3.4%)	Yes/31 (11.6%)	Yes/32 (12.0%)	No/22 (8.2%)	Yes/37 (13.9%)	Yes/24 (9.0%)	
NPII 12	Headwater Forest	Yes/27 (10.1%)	Yes/58 (21.7%)	Yes/35 (13.1%)	Yes/33 (12.4%)	Yes/37 (13.9%)	Yes/48 (18.0%)	
NPII 13	Headwater Forest	Yes/64 (24.0%)	Yes/ 81 (30.3%)	Yes/76 (28.5%)	Yes/70 (26.2%)	Yes/95 (35.6%)	Yes/86 (32.2%)	
NPII 14	Headwater Forest			Yes/36 (13.5%)	Yes/58 (21.7%)	Yes/45 (16.9%)	Yes/40 (15.0%)	
NPII 15	Headwater Forest			Yes/34 (12.7%)	Yes/24 (9.0%)	Yes/44 (16.5%)	Yes/40 (15.0%)	
NPII 16	Headwater Forest			Yes/53 (19.9%)	Yes/59 (22.1%)	Yes/50 (18.7%)	Yes/51 (19.1%)	
NPII 17	Headwater Forest				Yes/24 (9.0%)	Yes/44 (16.5%)	Yes/50 (18.7%)	
NPII 18	Headwater Forest						No/22 (8.2%)	
NPC1	Non-credited Creation Area	11 (4.1%)	38 (14.2%)	35 (13.1%)	18 (6.7%)	24 (9.0%)	23 (8.6%)	
NPC2	Non-credited Creation Area	24 (9.0%)	61 (22.8%)	71 (26.6%)	61 (22.8%)	59 (22.1%)	53 (19.9%)	

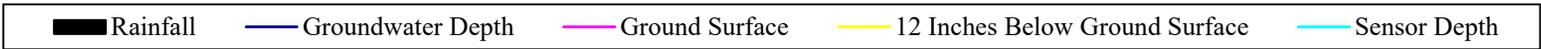
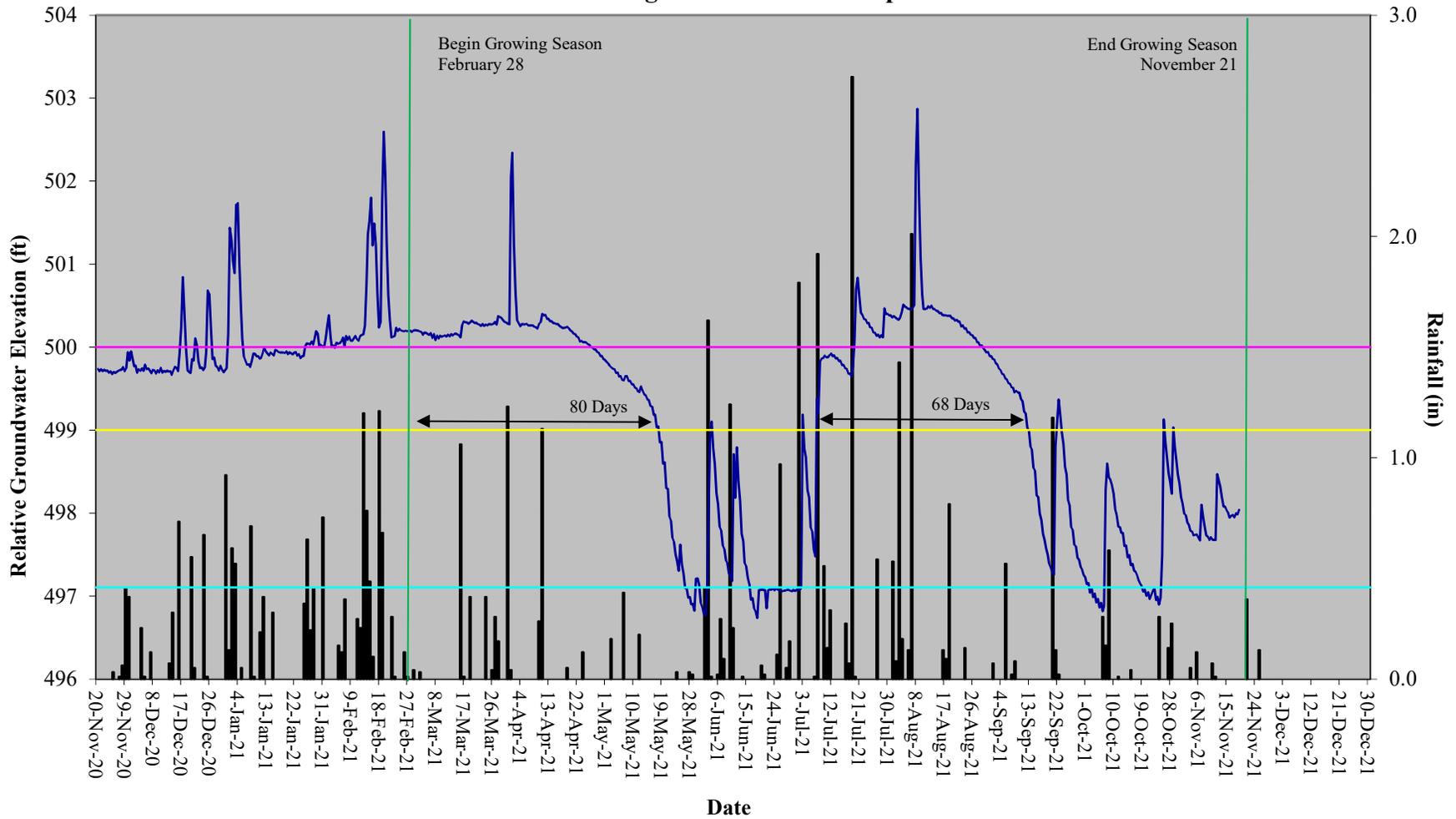
**Norman's Pasture Wetland Restoration Site
30-70 Percentile Graph
WETS Station Name: Clinton, NC**



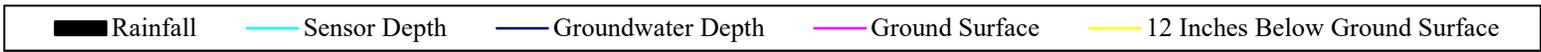
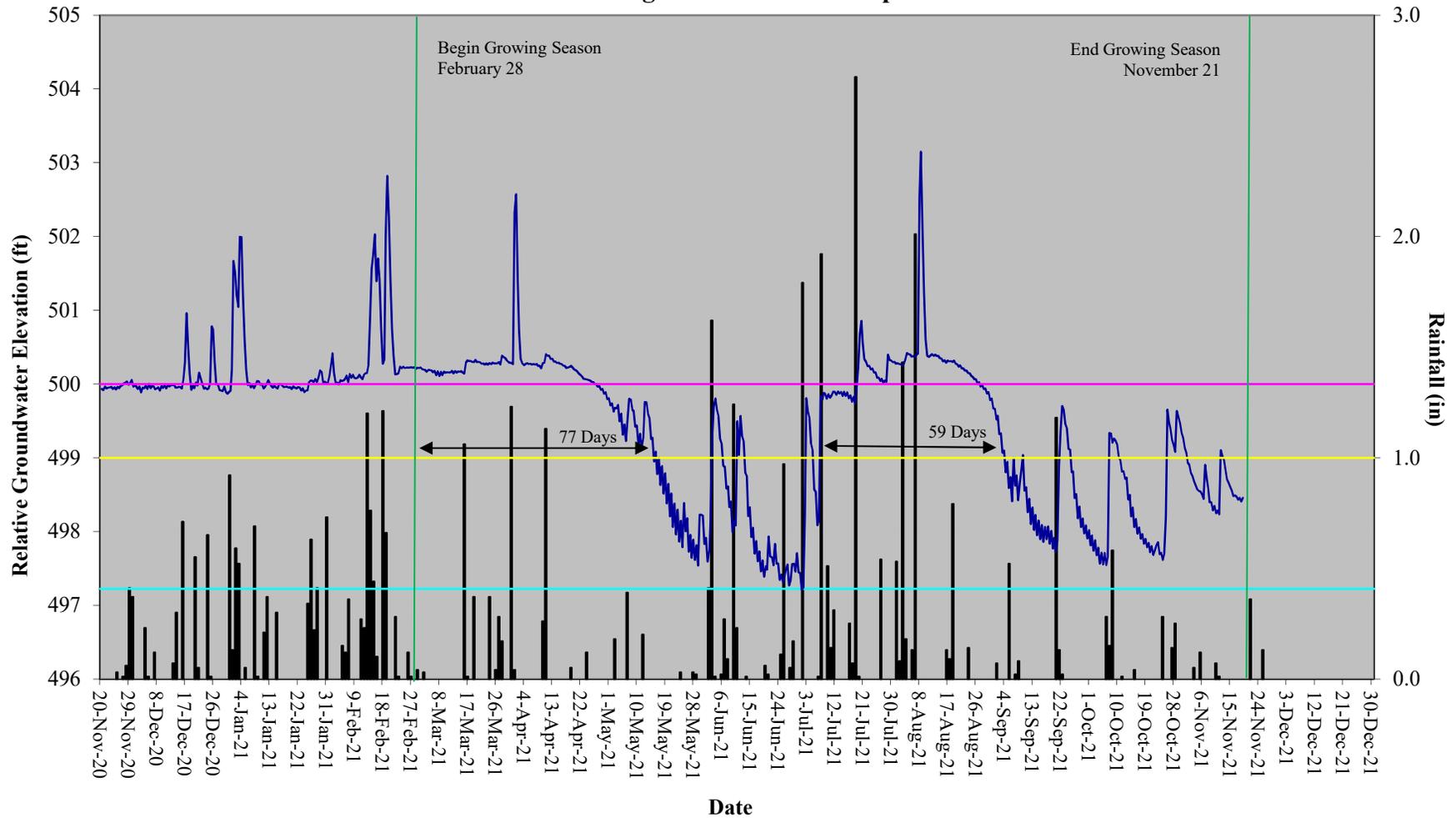
Norman's Pasture Restoration Site Hydrograph Wetland Gauge 1 - Headwater Forest



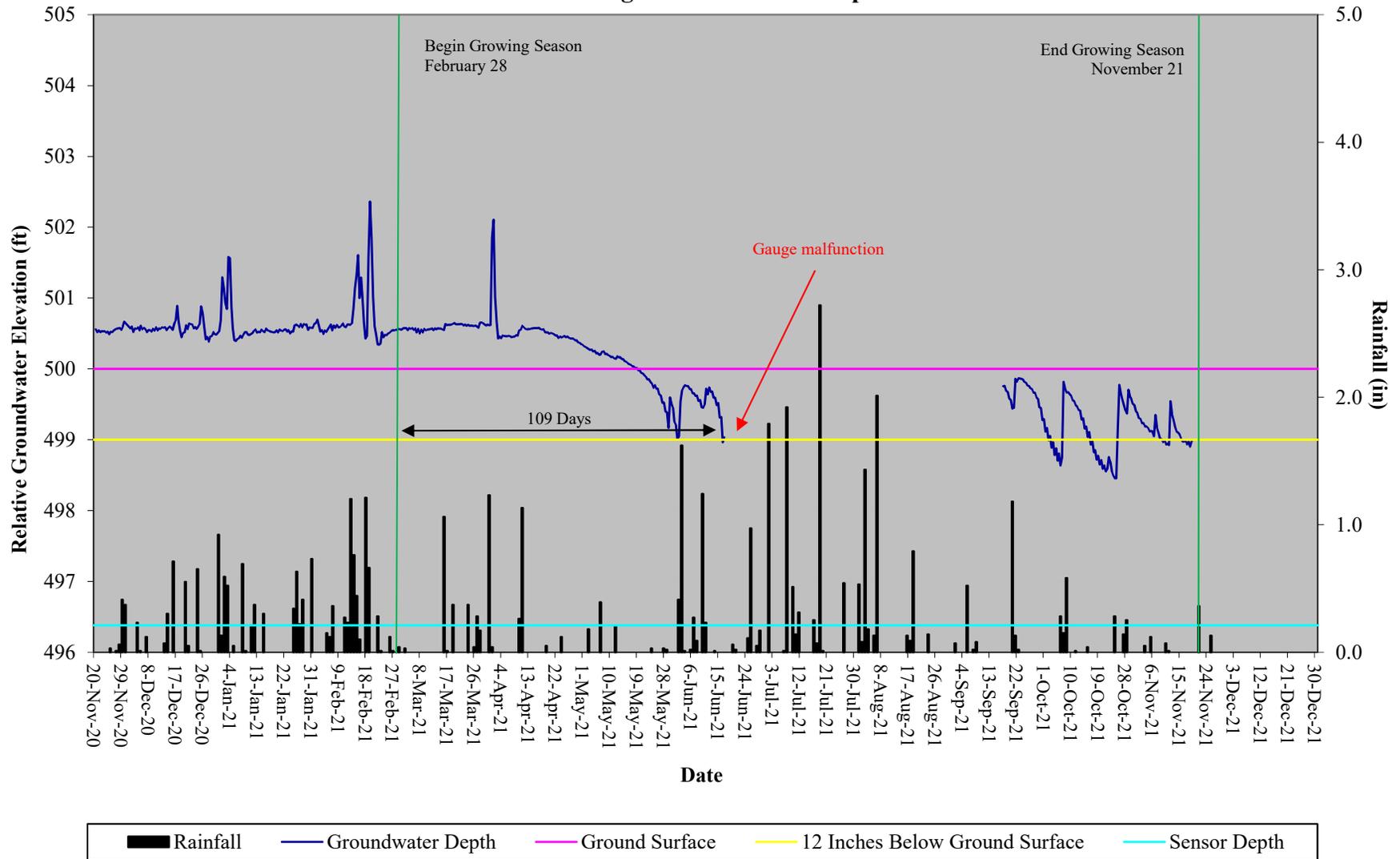
Norman's Pasture Restoration Site Hydrograph Wetland Gauge 2 - Riverine Swamp Forest



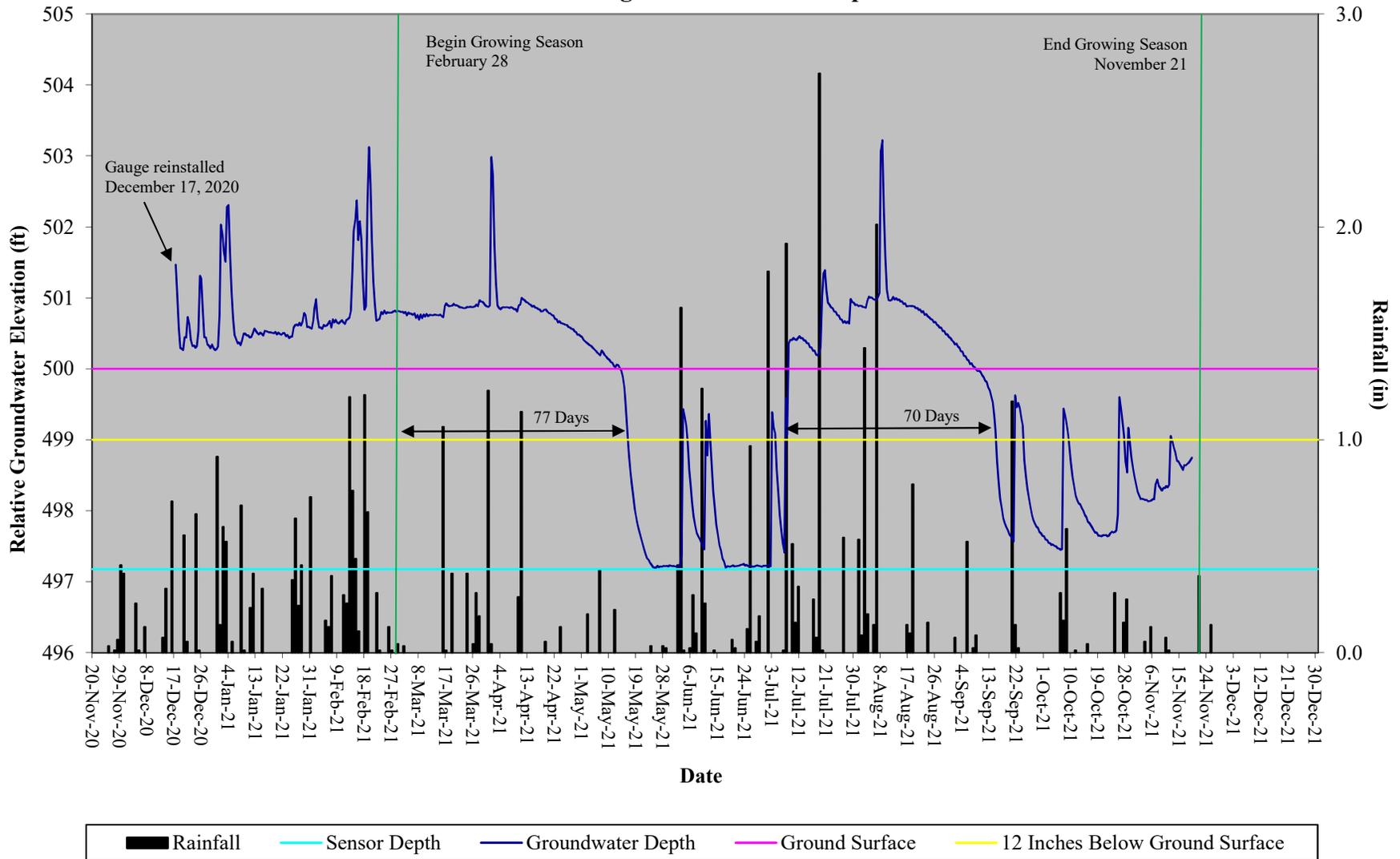
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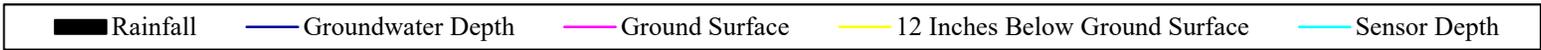
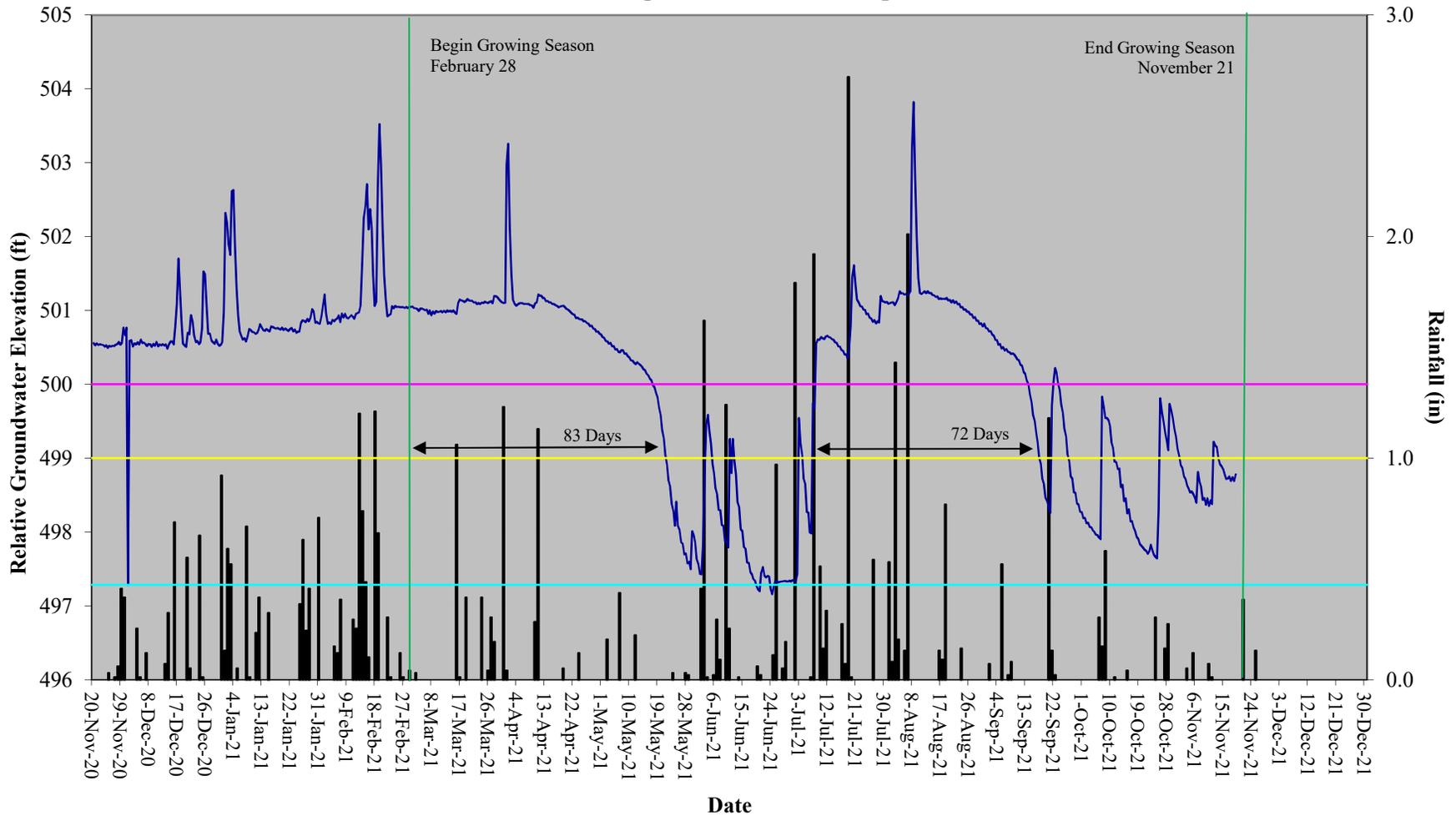
Norman's Pasture Restoration Site Hydrograph Wetland Gauge 4 - Riverine Swamp Forest



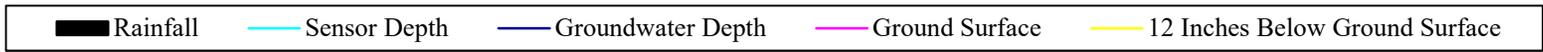
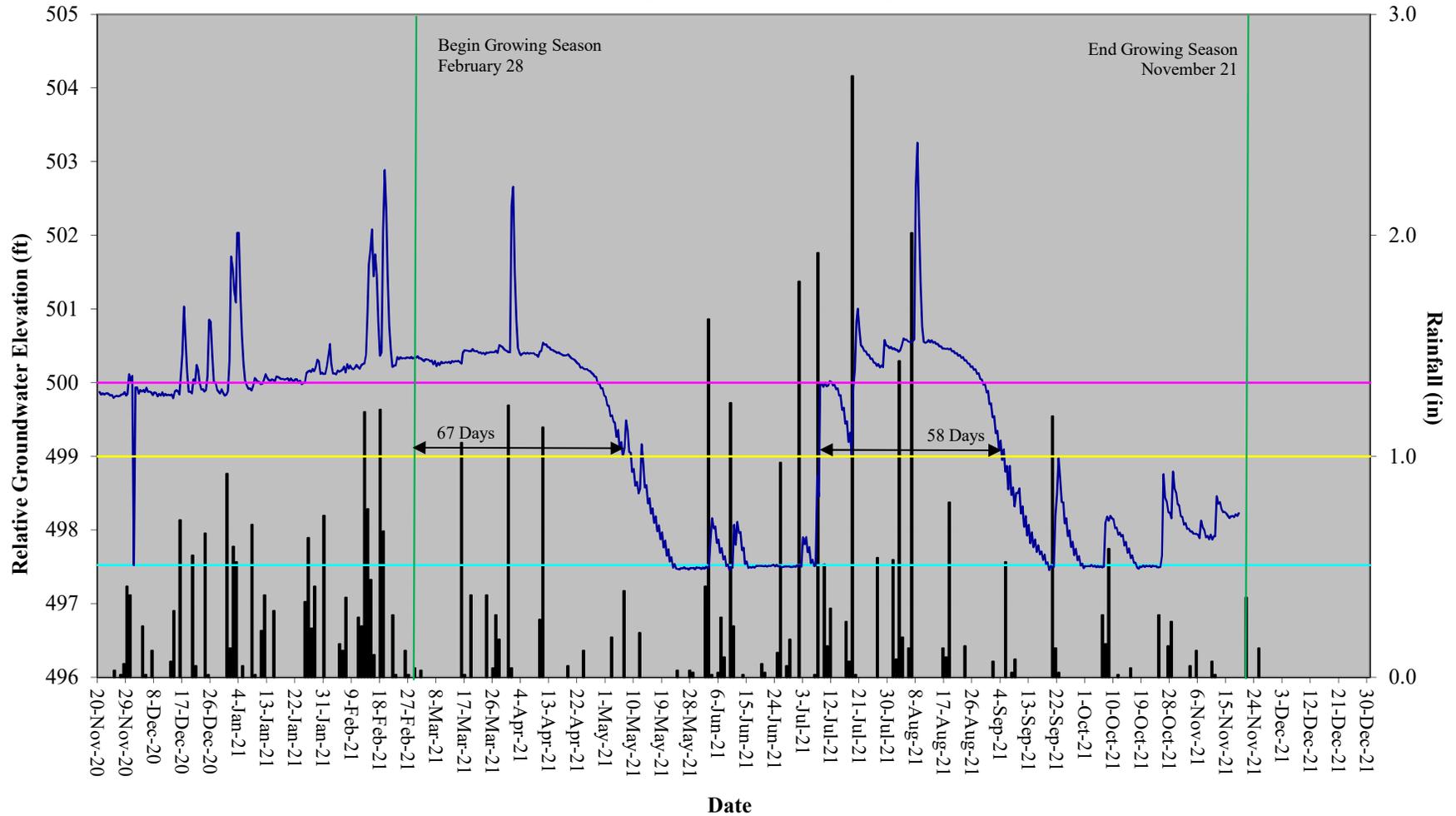
Norman's Pasture Restoration Site Hydrograph Wetland Gauge 5 - Riverine Swamp Forest



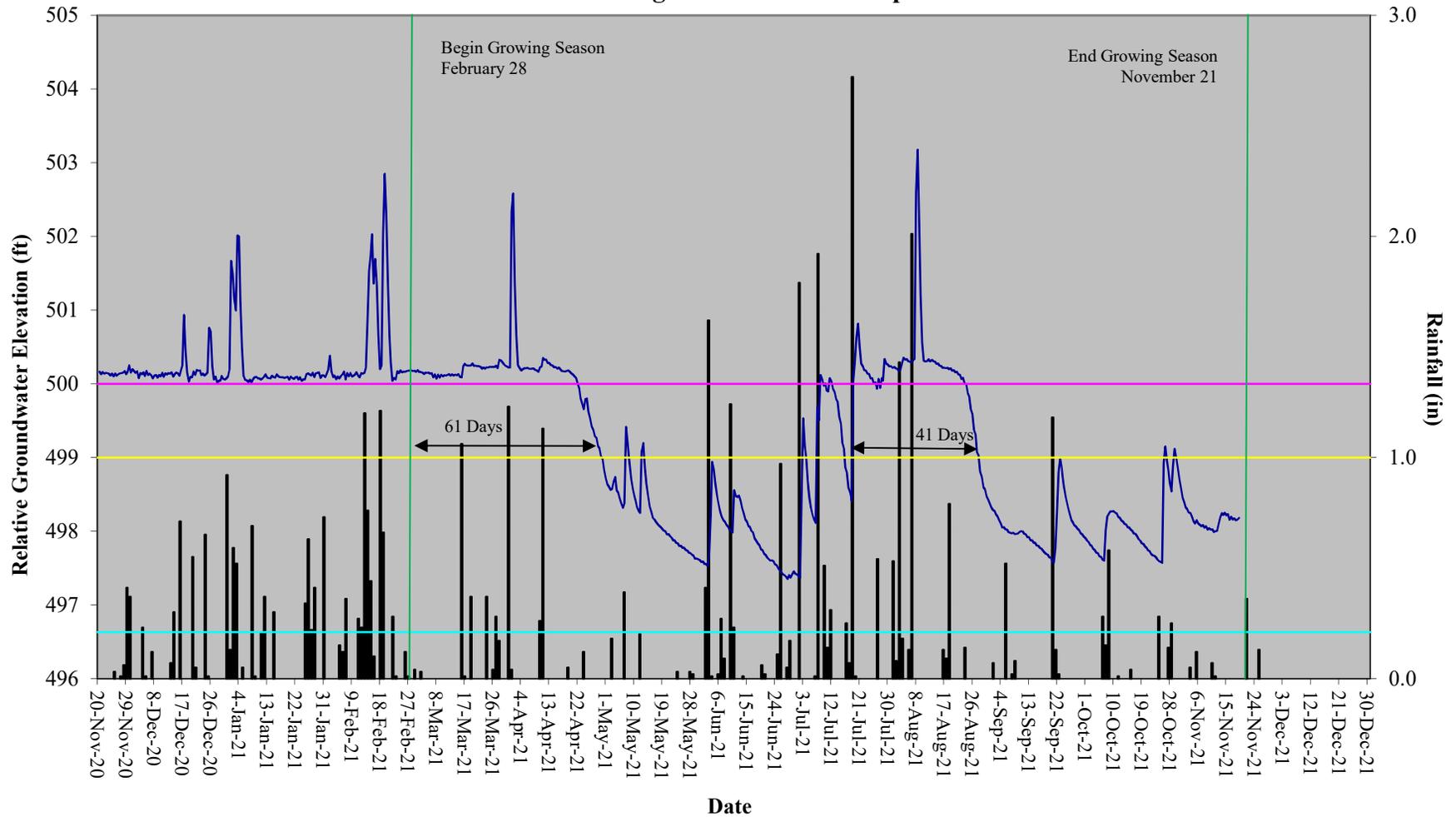
Norman's Pasture Restoration Site Hydrograph Wetland Gauge 6 - Riverine Swamp Forest



Norman's Pasture Restoration Site Hydrograph Wetland Gauge 7 - Riverine Swamp Forest

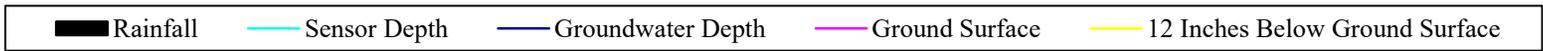
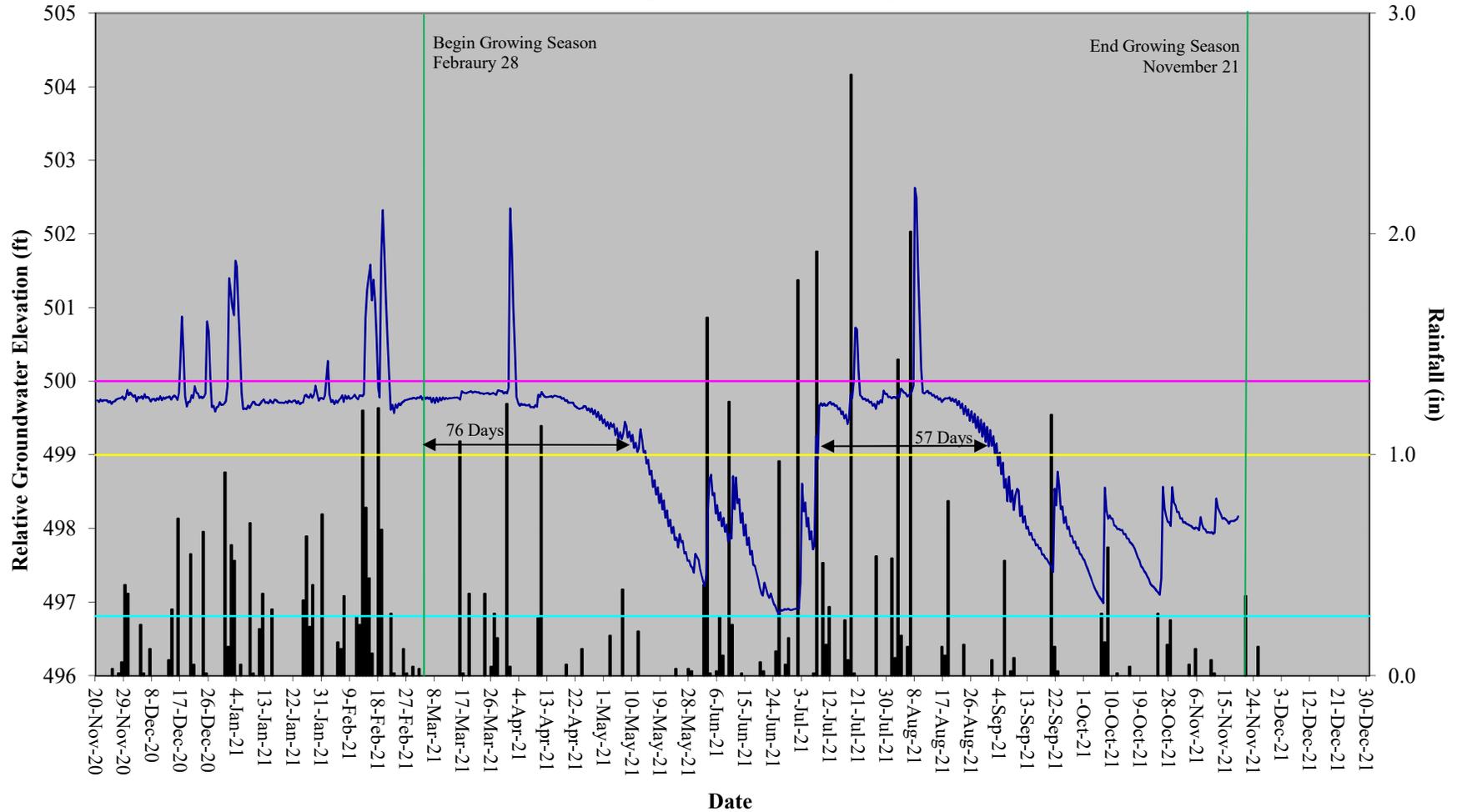


Norman's Pasture Restoration Site Hydrograph Wetland Gauge 8 - Riverine Swamp Forest

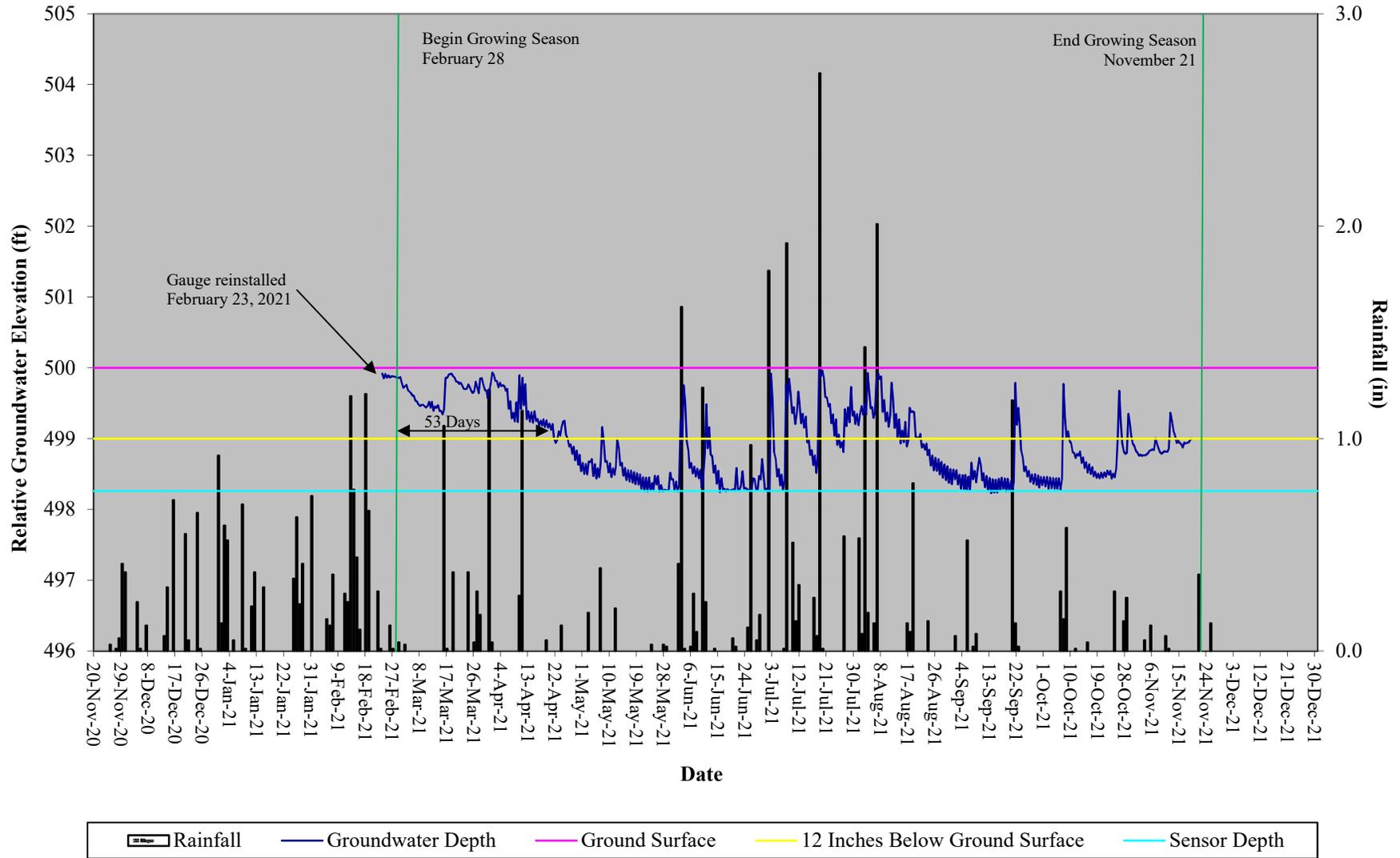


- Rainfall
- Groundwater Depth
- Ground Surface
- 12 Inches Below Ground Surface
- Sensor Depth

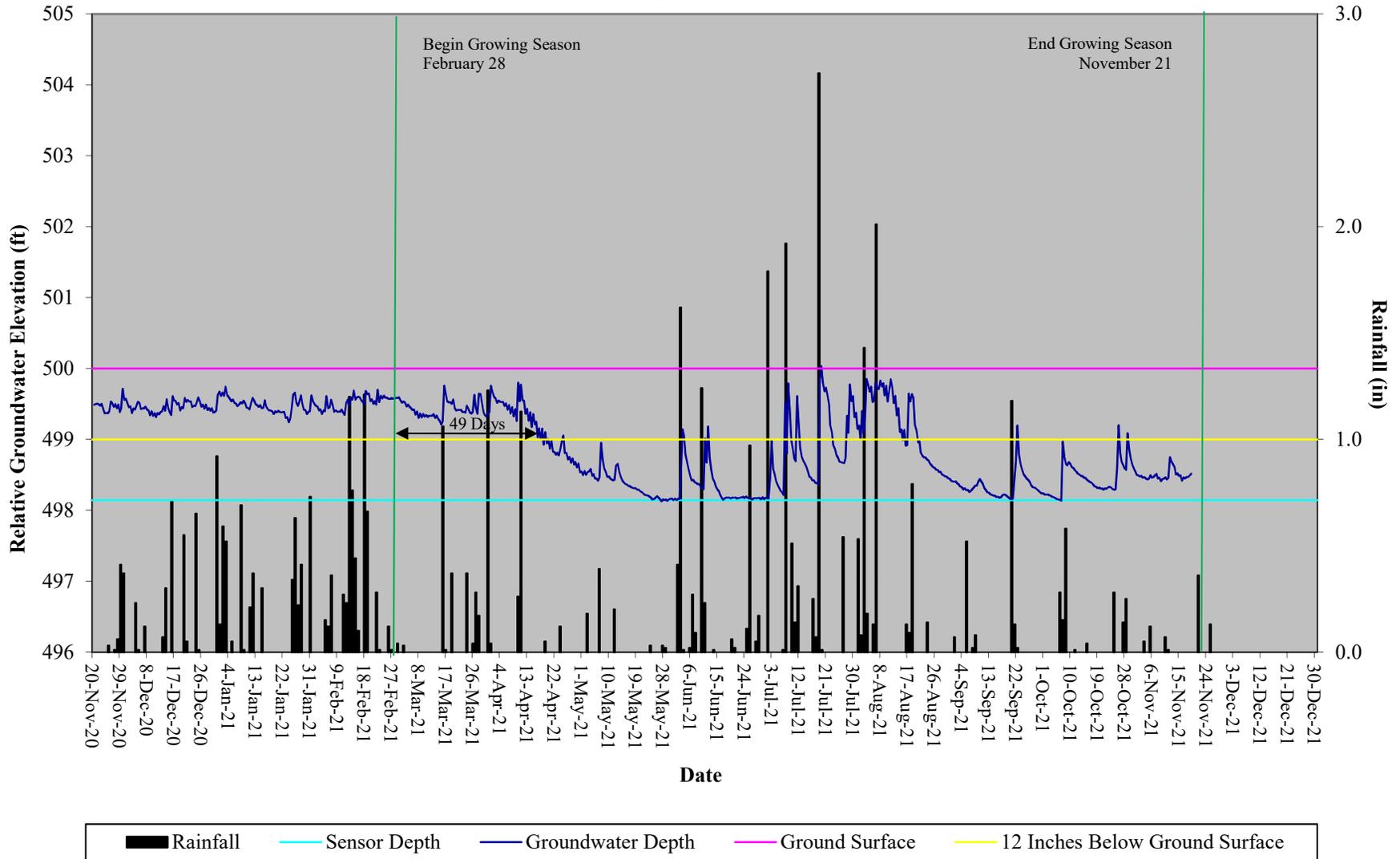
Norman's Pasture Restoration Site Hydrograph Wetland Gauge 9 - Riverine Swamp Forest



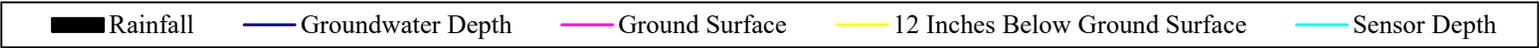
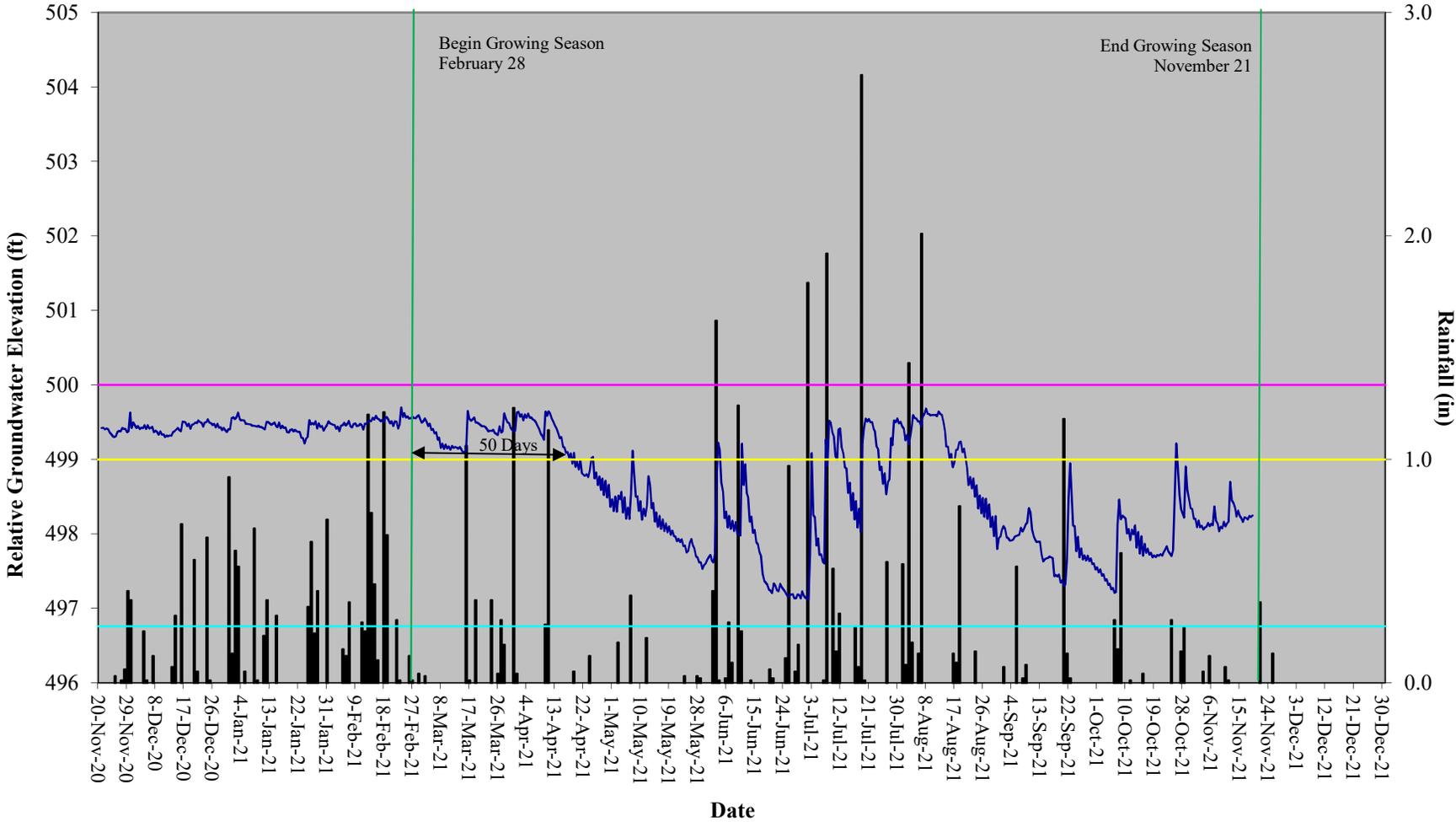
Norman's Pasture II Restoration Site Hydrograph Wetland Gauge 1 - Headwater Forest



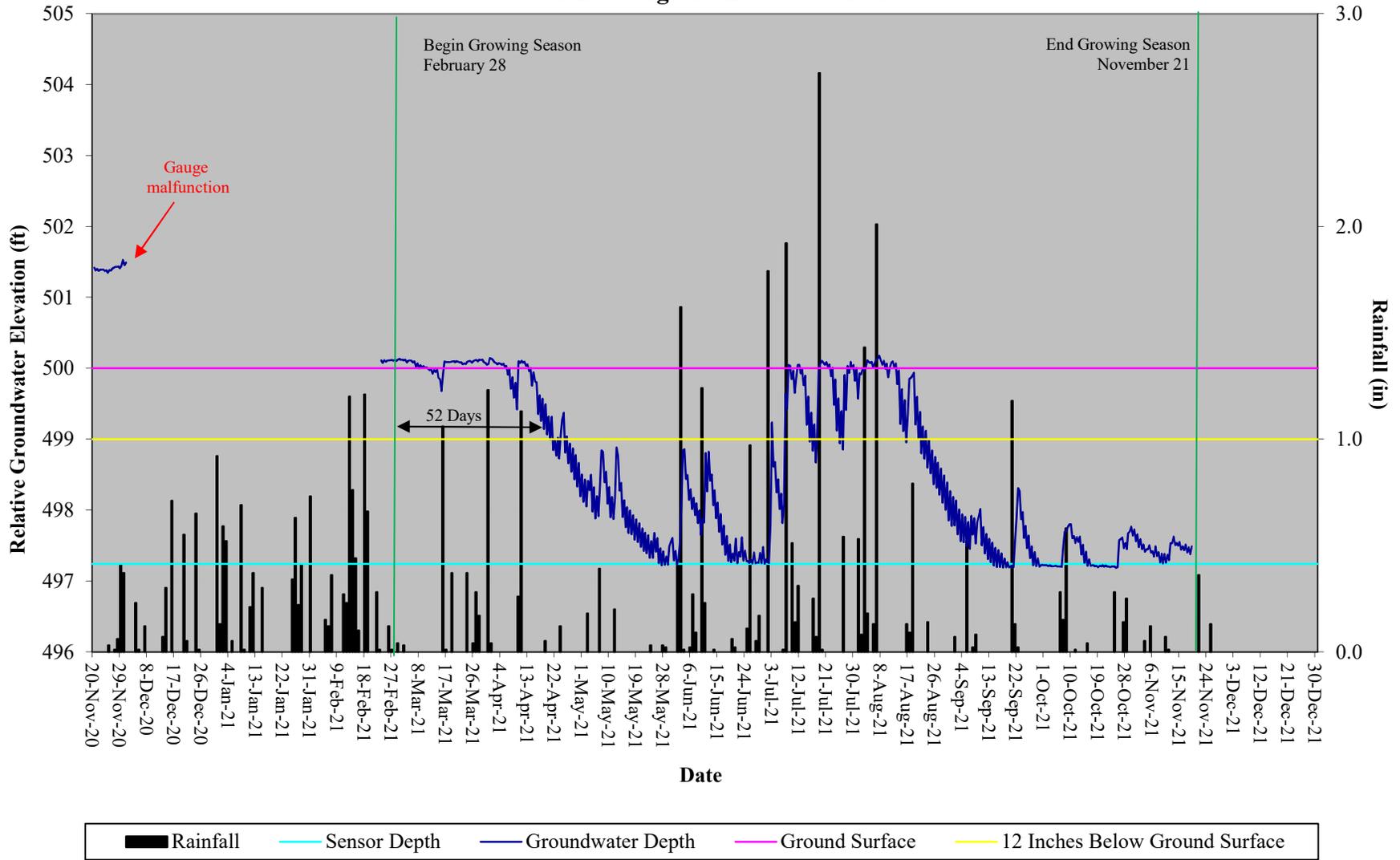
Norman's Pasture II Restoration Site Hydrograph Wetland Gauge 2 - Headwater Forest



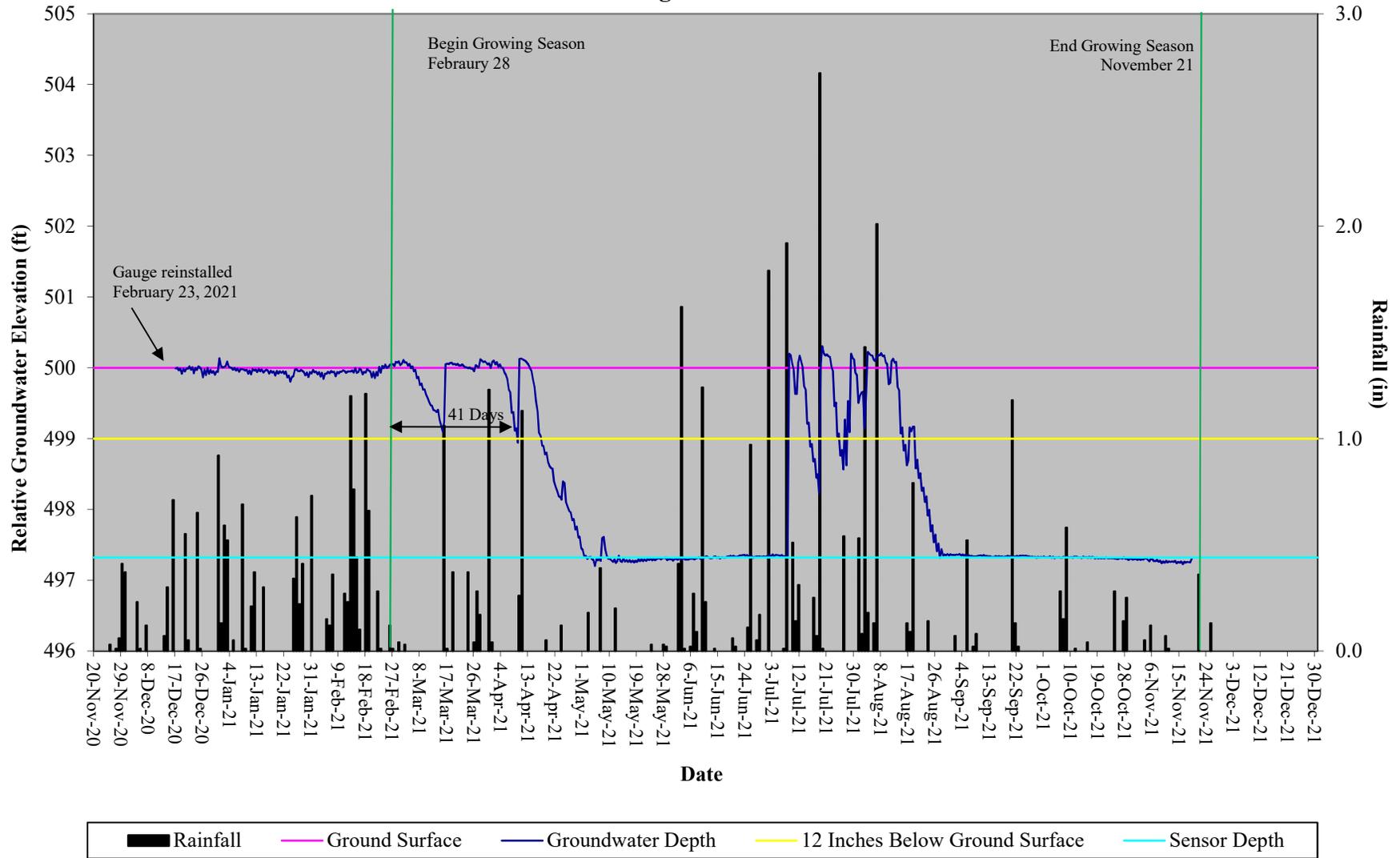
Norman's Pasture II Restoration Site Hydrograph Wetland Gauge 3 - Headwater Forest



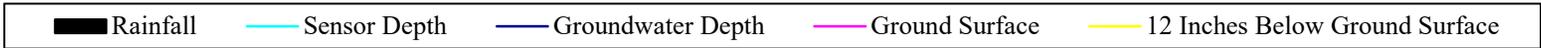
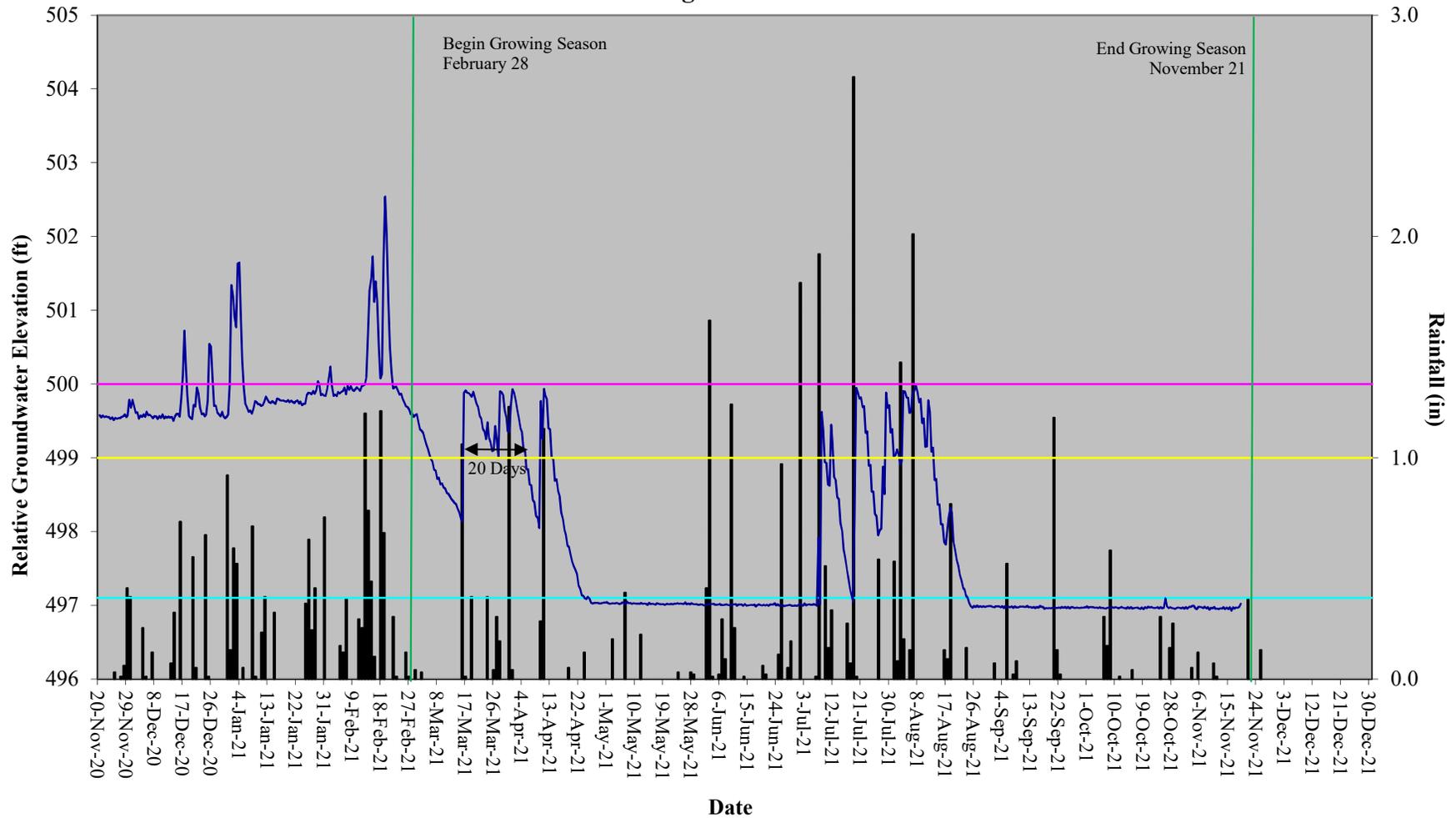
Norman's Pasture II Restoration Site Hydrograph Wetland Gauge 4 - Headwater Forest



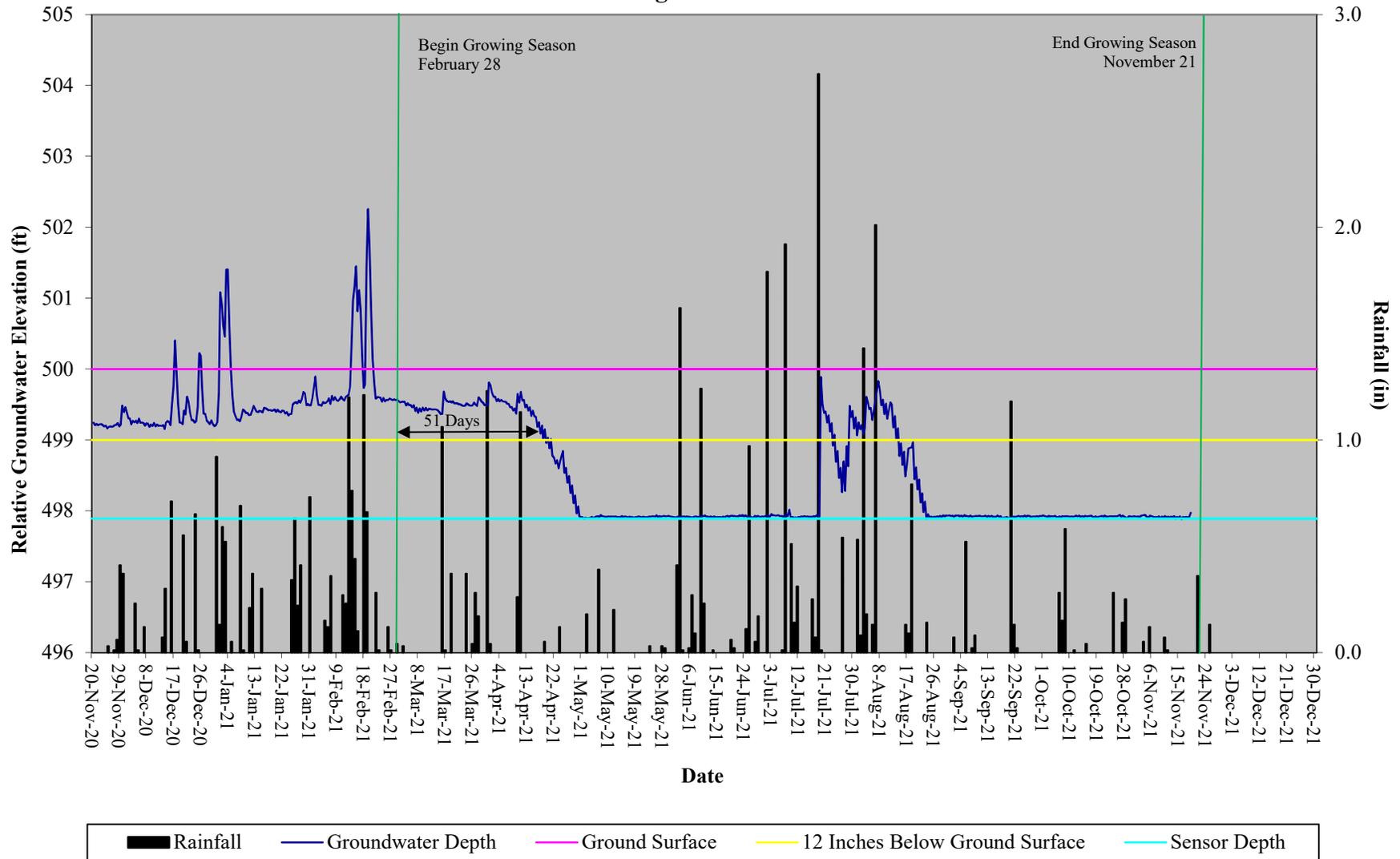
Norman's Pasture II Restoration Site Hydrograph Wetland Gauge 5 - Headwater Forest



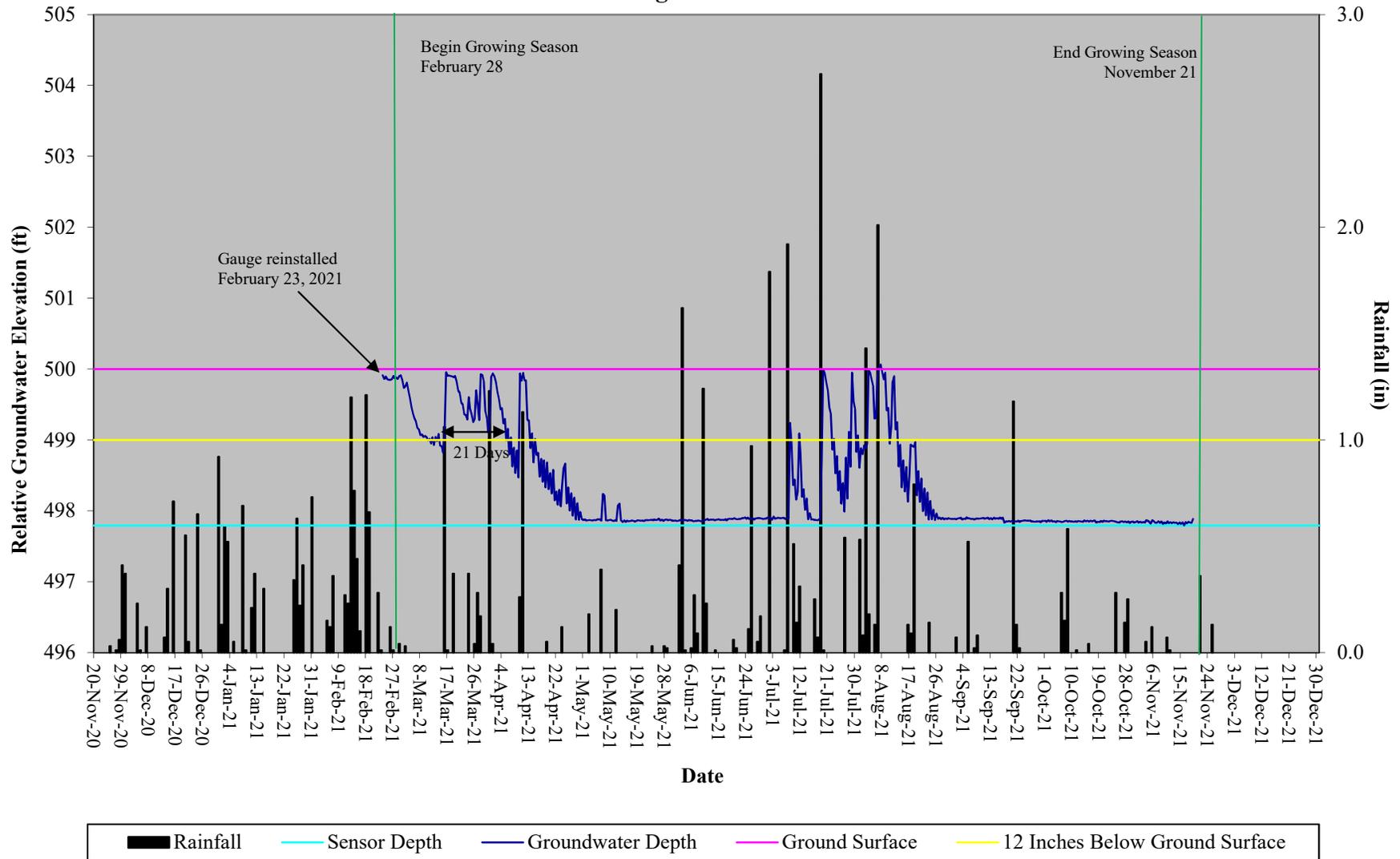
Norman's Pasture II Restoration Site Hydrograph Wetland Gauge 6 - Headwater Forest



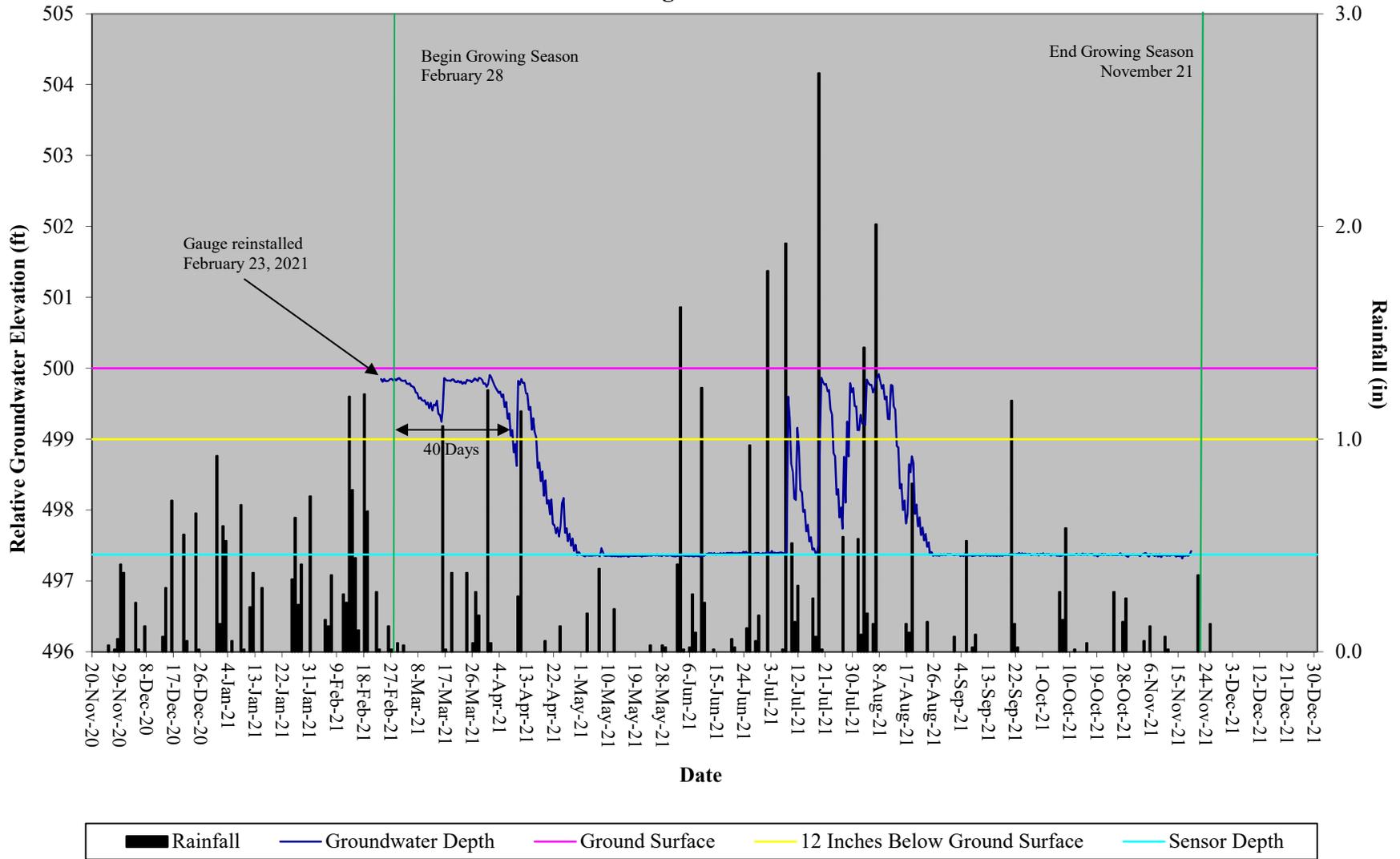
Norman's Pasture II Restoration Site Hydrograph Wetland Gauge 7 - Headwater Forest



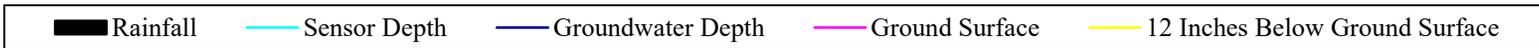
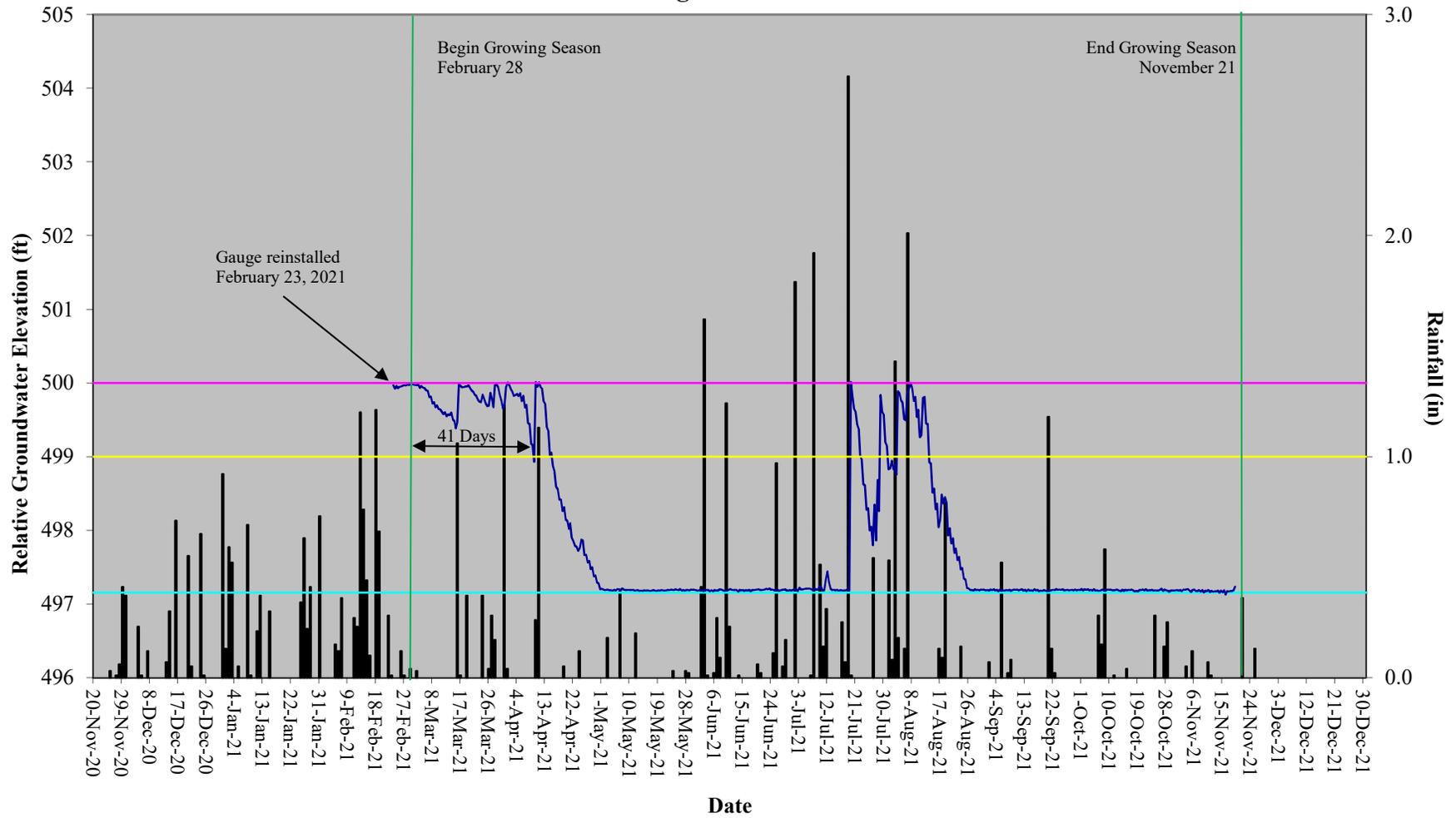
Norman's Pasture II Restoration Site Hydrograph Wetland Gauge 8 - Headwater Forest



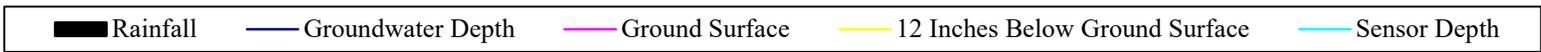
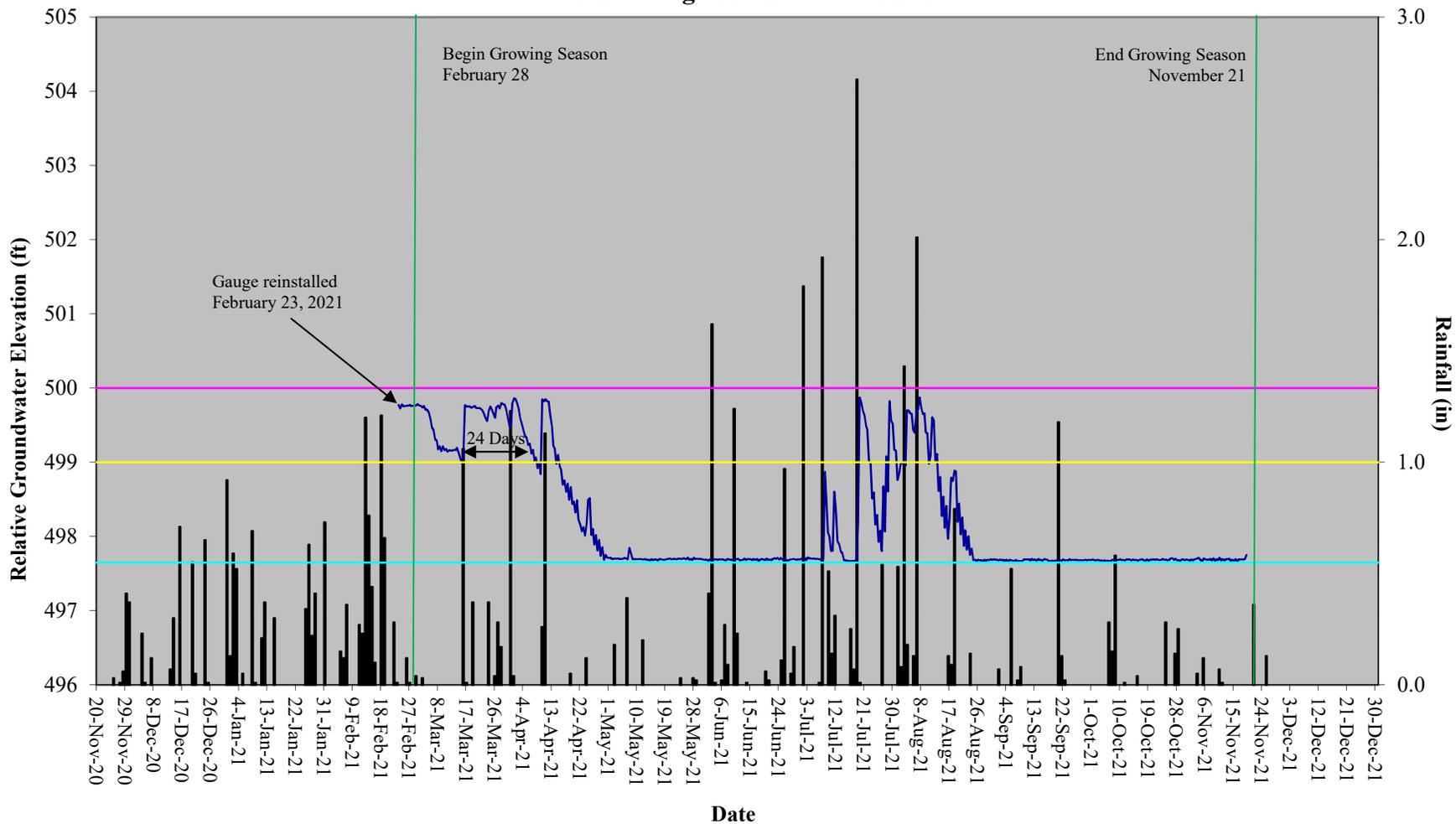
Norman's Pasture II Restoration Site Hydrograph Wetland Gauge 9 - Headwater Forest



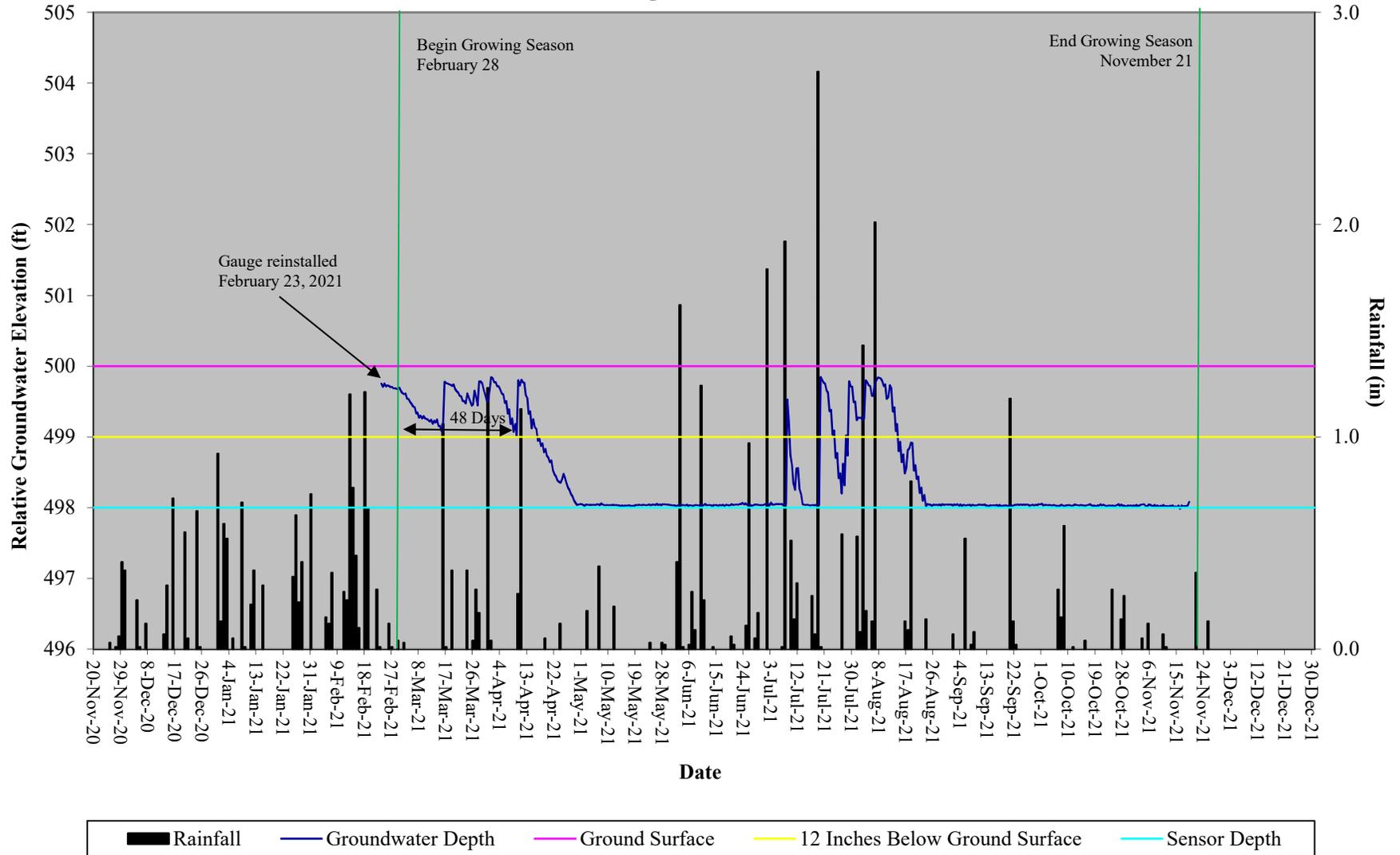
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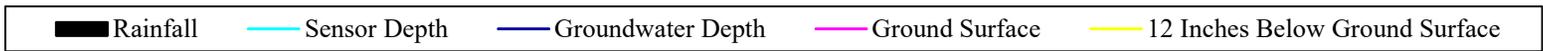
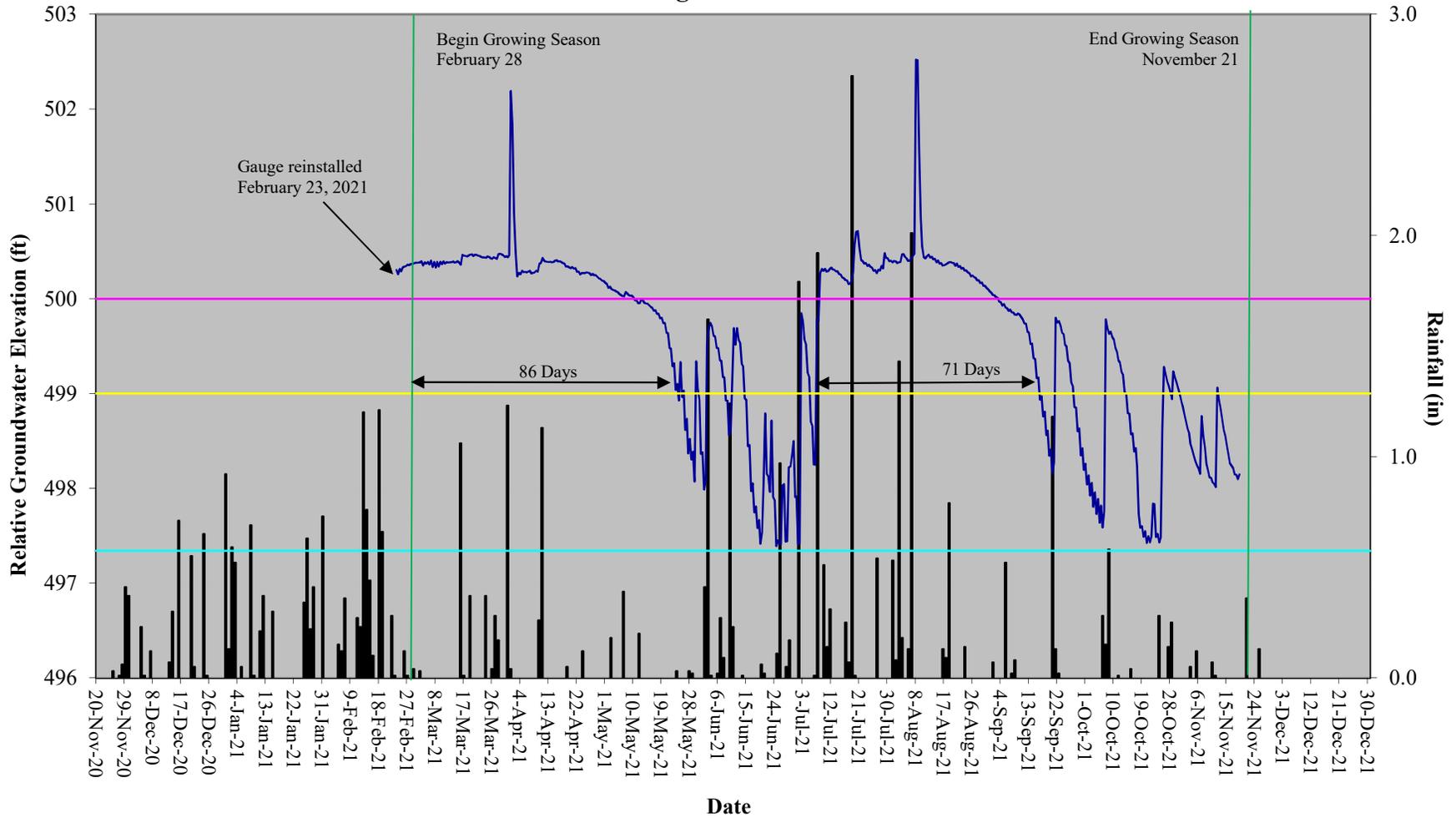
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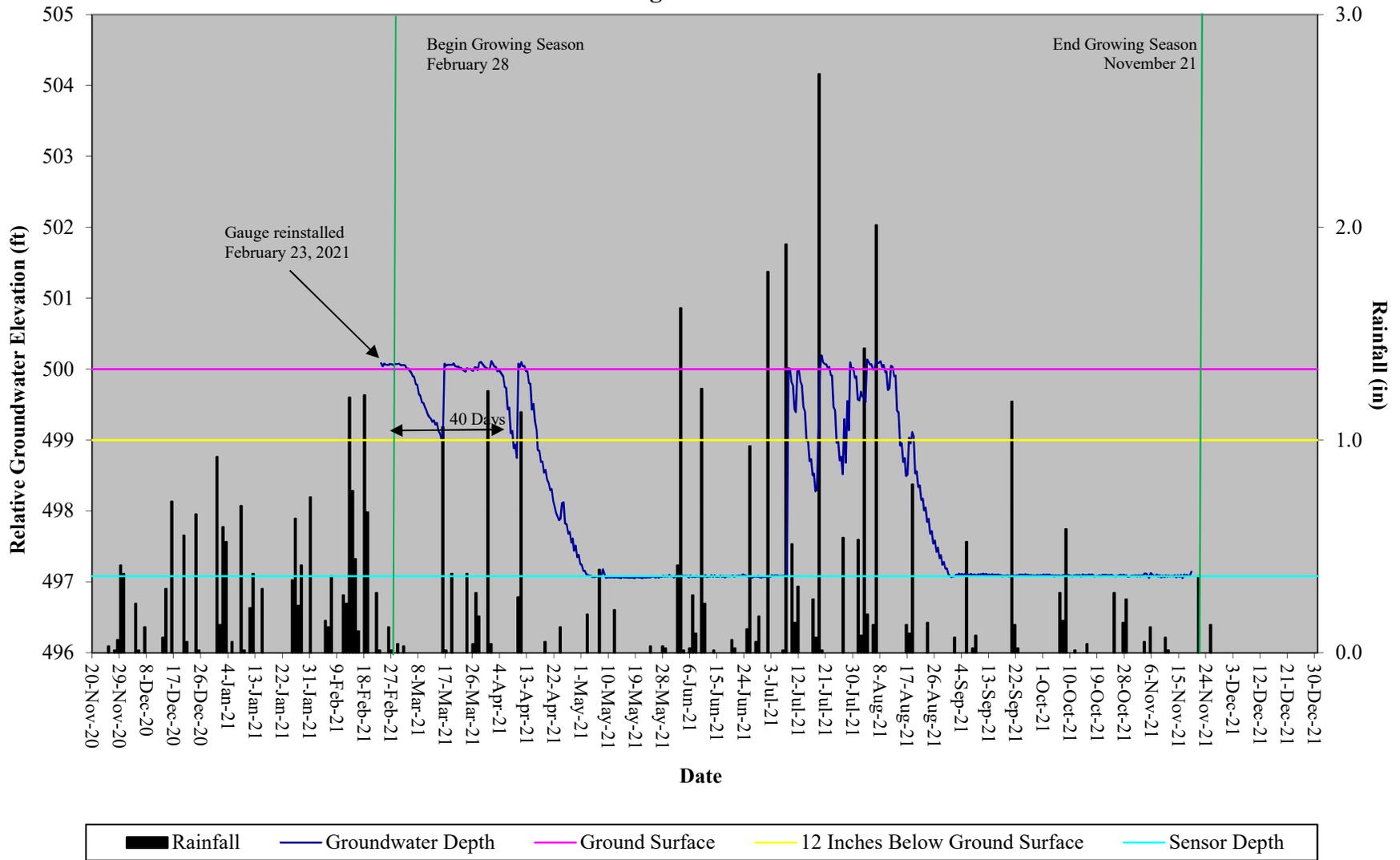
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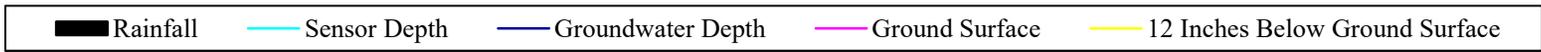
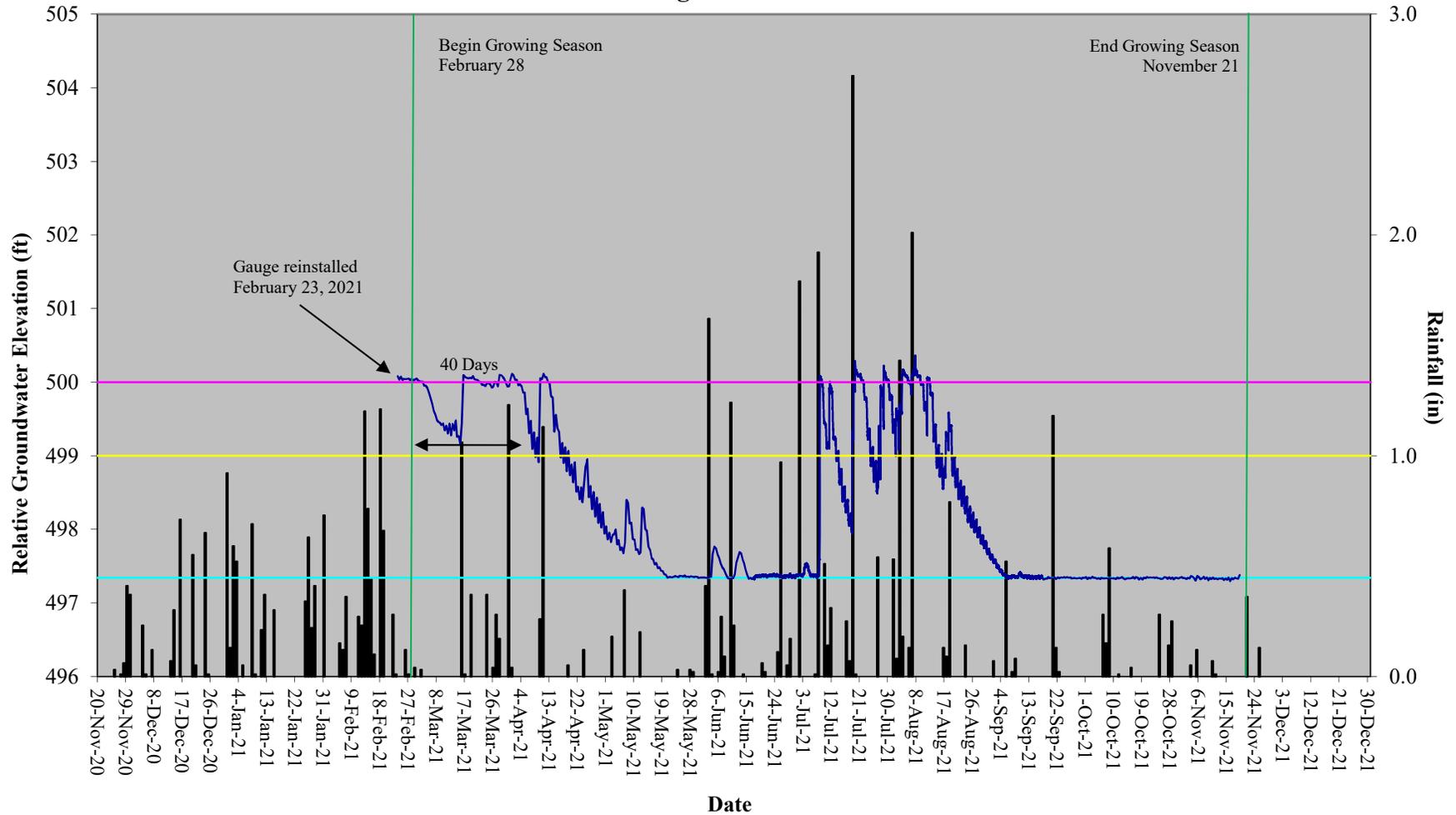
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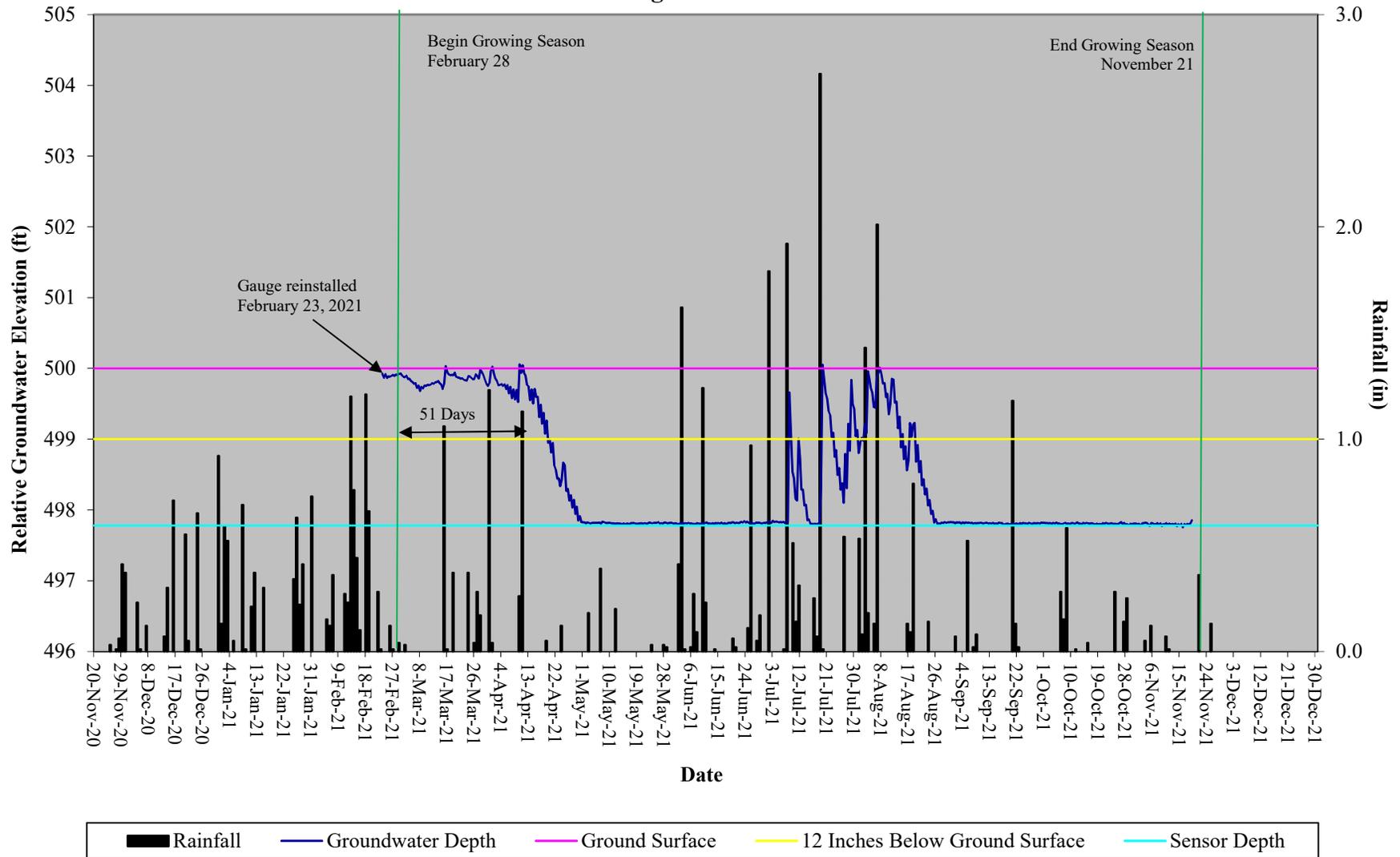
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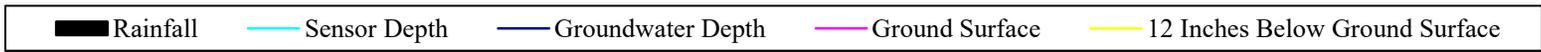
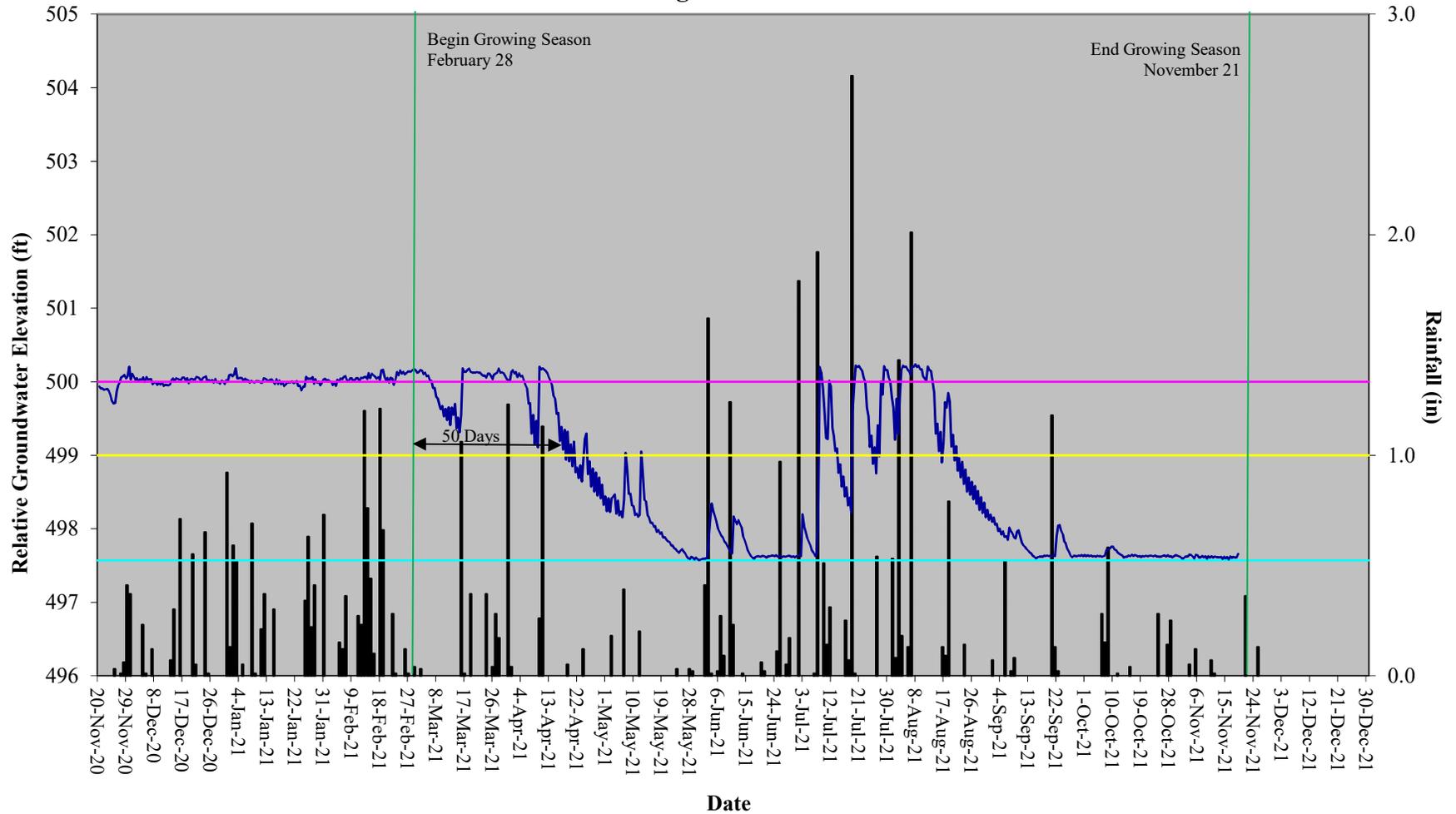
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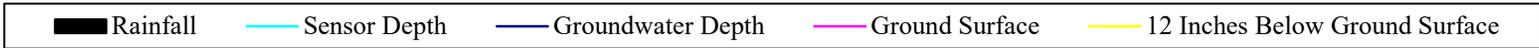
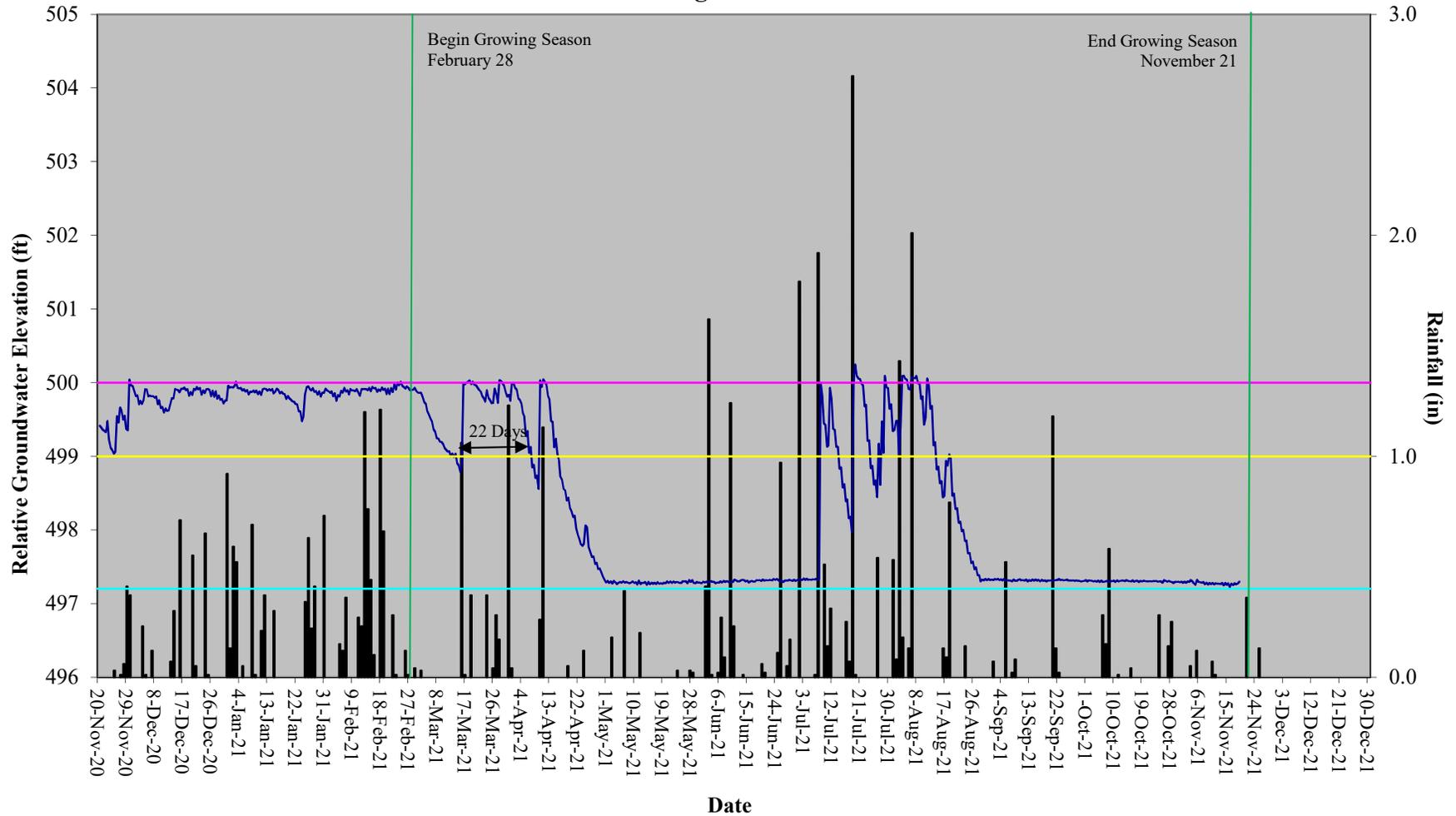
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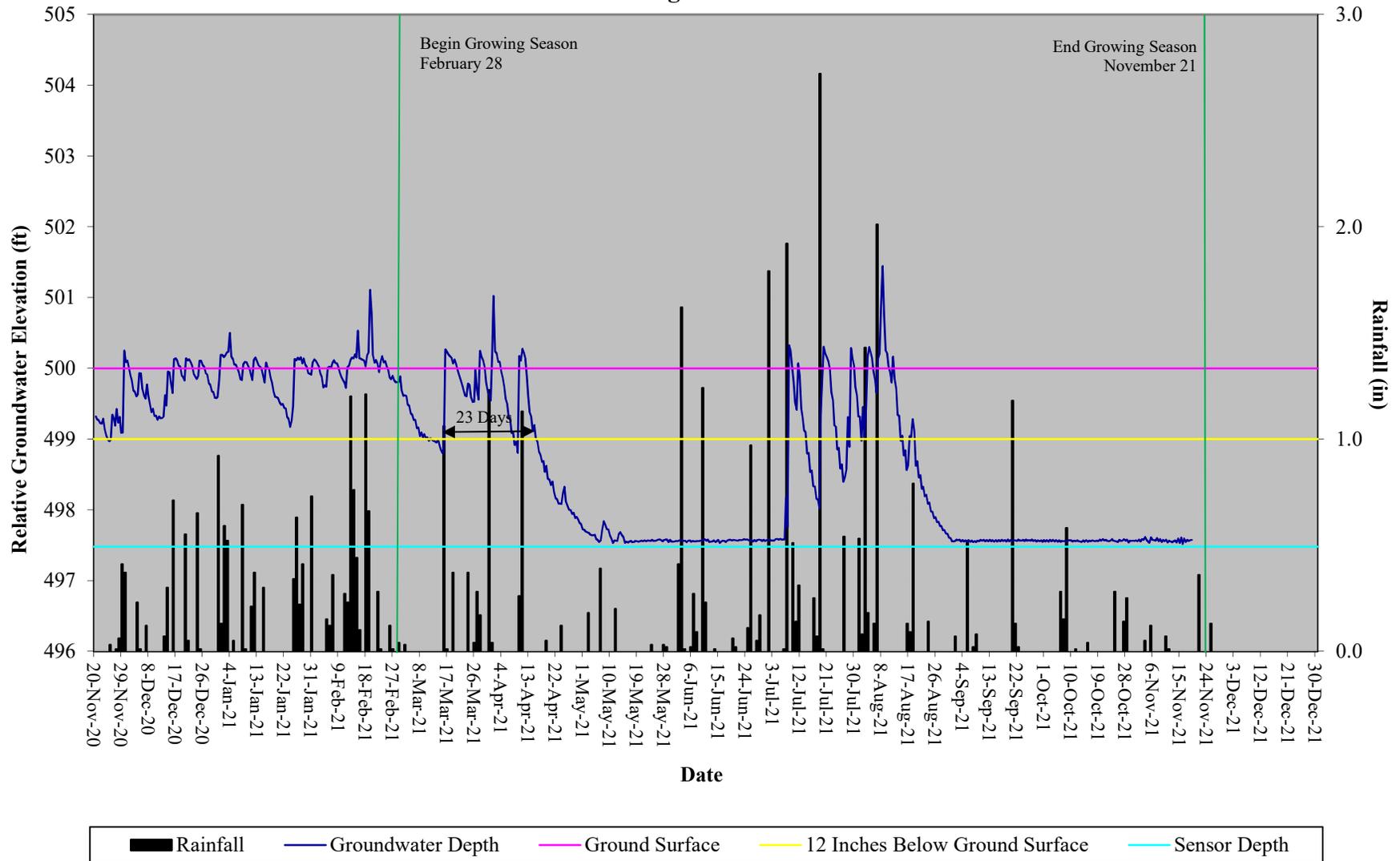
Norman's Pasture II Restoration Site Hydrograph Wetland Gauge 17 - Headwater Forest



Norman's Pasture Restoration Site Hydrograph Wetland Gauge 18 - Headwater Forest



Norman's Pasture Restoration Site Hydrograph Wetland Gauge C1 - non credit zone



Norman's Pasture Restoration Site Hydrograph Wetland Gauge C2 - **non-credit zone**

