

**Bear Basin Restoration Site
Monitoring Report MY05
DMS Project # 95362
DMS Contract # 004741**

**Onslow County, NC
CU# 03030001
DWR# 2013-0456
SAW# 2012-01391**



Submitted to:

[NCDMS, 1652 Mail Service Center, Raleigh, NC 27699-1652](#)

**Construction Completed: February 2015
Data Collection: 2019
Submitted: December 2019**

Monitoring and Design Firm



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**Project Manager: Tim Morris
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KCI Project No: 20122266**



MEMORANDUM

Date: February 6, 2020
To: Lindsay Crocker, DMS Project Manager
From: Adam Spiller, Project Manager
KCI Associates of North Carolina, PA
Subject: MY-05 Monitoring Report Comments
Bear Basin DMS#95362, Contract 004741
White Oak River Basin CU 03030001
Onslow County, North Carolina

Please find below our responses in italics to the MY-05 Monitoring Report comments from NCDMS received on January 17, 2020, for the Bear Basin Wetland Restoration Site.

1. Check that the rainfall data presented in the table is from the closest precipitation gauge, it may be helpful to check antecedent rainfall in determining cause for hydrology concerns in MY5.
KCI Response: The rainfall data presented is from the Albert J. Ellis Airport (KOAJ), which is located approximately 6.5 miles from the site. The next closest rain station is the New River Marine Corps Air Station (MCAS), which is located approximately 18 miles from the site. The yearly rainfall total based on the KOAJ data was drier than any of the years recorded in the county WETS table (1945-2000) and the rainfall total based on the MCAS data would have qualified as the fourth driest year on record. This extremely low amount of rain is responsible for the low rates of success achieved this year.
2. The Mitigation Plan has a March 18-November 16 growing season, but the report shows growing season beginning on April 8. Check and update this as it may significantly influence results of this report.
KCI Response: The growing season was erroneously reported as beginning April 8. This issue has been corrected.

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

Sincerely,

A handwritten signature in black ink that reads 'Adam Spiller'.

Adam Spiller
Project Manager

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1.0 EXECUTIVE SUMMARY / PROJECT ABSTRACT

The Bear Basin Restoration Site (BBRS) is a full-delivery project that was developed for the North Carolina Division of Mitigation Services (DMS). Construction was completed in February 2015. The site is within the 03030001 Watershed Cataloging Unit (8-digit HUC) and the Local Watershed Unit (14-digit HUC) 03030001010010. In DMS' most recent publication of excluded and Targeted Local Watersheds/Hydrologic Units, the 03030001010010 14-digit HUC has been identified as a Targeted Local Watershed.

The project site, which is protected by an 11.9-acre permanent conservation easement held by the State of North Carolina, is situated in Onslow County in the Carolina Flatwoods ecoregion of the Coastal Plains physiographic province. The site is located on a single parcel located off of Jesse Williams Road approximately five miles west of Richlands, North Carolina.

The project goals and objectives are listed below.

Project Goals

- Protect and improve water quality by reducing sediment and nutrient inputs
- The protection of a watershed draining into shellfish harvesting waters
- Provide habitat for aquatic flora and fauna by improving physical structure and vegetative composition
- Increase the local hydroperiod by encouraging both surface and subsurface storage and retention
- Restore and establish a functional and diverse wetland community

Project Objectives

- Fill field ditches to restore surface flow retention and elevate local groundwater levels.
- Redevelop longer wetland flow patterns to increase surface flow retention time.
- Restore a diverse wetland vegetation community through maintenance and germination of existing wetland seed stores, planting of wetland trees and shrubs, and incorporation of a custom wetland seed mix.

The BBRS provided mitigation for wetland impacts within Hydrologic Unit 03030001 by restoring 8.6 acres of wetland and preserving 1.9 acres of upland, generating 8.6 non-riparian wetland mitigation units (WMU's). The wetland site will be monitored to determine if the project is on-track to meeting jurisdictional wetland status. In the restoration areas, the wetland site will be deemed successful once hydrology is established and vegetation success criteria are met. The site will be monitored for at least seven years or until the success criteria are achieved.

As designed, the western and southernmost ditches, located adjacent to the project easement were left open and not filled during construction. It is anticipated that leaving these ditches open will have minimal impacts to the overall hydrologic performance of the site. The hydrologic influence of these ditches was modeled using Lateral Effect, a software program that determines the lateral effect of a drainage ditch or borrow pit on adjacent wetland hydrology (NCSU BAE, 2011). This analysis determined that the potential horizontal drainage influence averages 85'. Due to the fact that these ditches cannot be filled because of the potential for hydrologic trespass, the area immediately adjacent to the ditch will not be a credit generating part of the site. It is assumed that with the onsite modifications, such as filling field ditches and surface roughening, the entire site will have more surface and groundwater storage, which may decrease the effect of the open ditches. For this reason, the non-credit generating portion of the site is assumed to be half of the zone of influence for the ditch.

2.0 MONITORING RESULTS

2.1 VEGETATION MONITORING

The success criteria for the planted species in the mitigation area will be based on survival. The site will demonstrate the re-establishment of targeted vegetative communities through the survival and growth of planted species and volunteer colonization, with an average stem density 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. To determine the success of the planted mitigation area, seven permanent vegetation monitoring plots (10 by 10 meters) have been established in the wetland restoration area at a density that represents the total mitigation acreage. The average density of these plots will determine whether the site meets the success criterion.

The fifth-year vegetation monitoring was based on the Level 2 CVS-EEP vegetation monitoring protocol. The site's average density for this monitoring period was 757 planted stems/acre. All seven plots had greater than 288 planted stems/acre. Including volunteers, the site averaged 1,451 total stems/acre. In general the site is well vegetated, with widespread herbaceous coverage and healthy planted stems. There is an area of open water that does not have significant vegetation. Over the course of the year, this area expands and shrinks with the seasons so that it reaches its fullest extent in the winter and its lowest during the summer. This results in areas around the edge that, while inundated during the winter, support vegetation during the winter. Species such as *Juncus effuses*, *Scirpus cyperinus*, *Scirpus atrovirens*, *Carex comosa*, *Carex vulpinodea*, and *Schoenoplectus tabernaemontani* are abundant in these areas. In December 2018, KCI used GPS to map the extent of the area that is inundated to the point of excluding vegetation year round and found it to be 0.87 acres. See Appendix B – Visual Assessment Data for more information.

2.2 HYDROLOGY MONITORING

Wetland hydrology will be monitored with a series of automatic gauges that record water table depth. The site must present continuous saturated or inundated hydrologic conditions for at least 8% of the growing season with a 50% probability of reoccurrence during normal weather conditions. A “normal” year is based on NRCS climatological data for Onslow County 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, April 2000.” The growing season for Onslow County is considered to extend from March 18 to November 16 (244 days). The water table of the restored wetlands must be within 12” of the soil surface continuously for at least 8% (20 days) of the 244-day growing season. Wetland hydrology will be monitored with twenty automatic gauges that record water table depth.

To monitor the effect of the unfilled ditches described in Section 1.0, four sets of coupled gauges were installed perpendicular to the unfilled ditches. Each set includes a gauge that is 50’ from the open ditch and another that is 80’ from the ditch. An additional four gauges were installed between the coupled gauges to monitor hydrology less than 42.5’ from the open ditch in the non-credit bearing zone.

The daily rainfall data was obtained from a local weather station in Jacksonville, NC; provided by the NC State Climate Office. For the 2019 year, the months of April, September, October and November experienced average rainfall, while January, February, March, May, June, July, and August, experienced below average rainfall. No months recorded above average rainfall for the site. Overall, the area experienced well below average rainfall during the 2019 growing season.

During the site's fifth growing season, only 9 of the 21 credit bearing gauges achieved the success criteria. Collectively the credit bearing gauges averaged 8.5% (20 days) continuous saturation during the growing

season. Additionally, one of the four non-credit bearing gauges achieved the success criteria. The low rate of success this year is due to the extremely low amount of rainfall that the site received.

3.0 METHODOLOGY

The CVS-EEP protocol, Level 2 (<http://cvs.bio.unc.edu/methods.htm>) was used to collect vegetation data from the site. The vegetation monitoring was completed on July 25, 2019.

4.0 REFERENCES

Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation, Version 4.0 (<http://cvs.bio.unc.edu/methods.htm>)

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

Sprecher, S. W. and Warne, A. G. 2000. "Accessing and Using Meteorological Data to Evaluate Wetland Hydrology," ERDC/EL TR-WRAP-00-01, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Appendix A

Project Vicinity Map and Background Tables

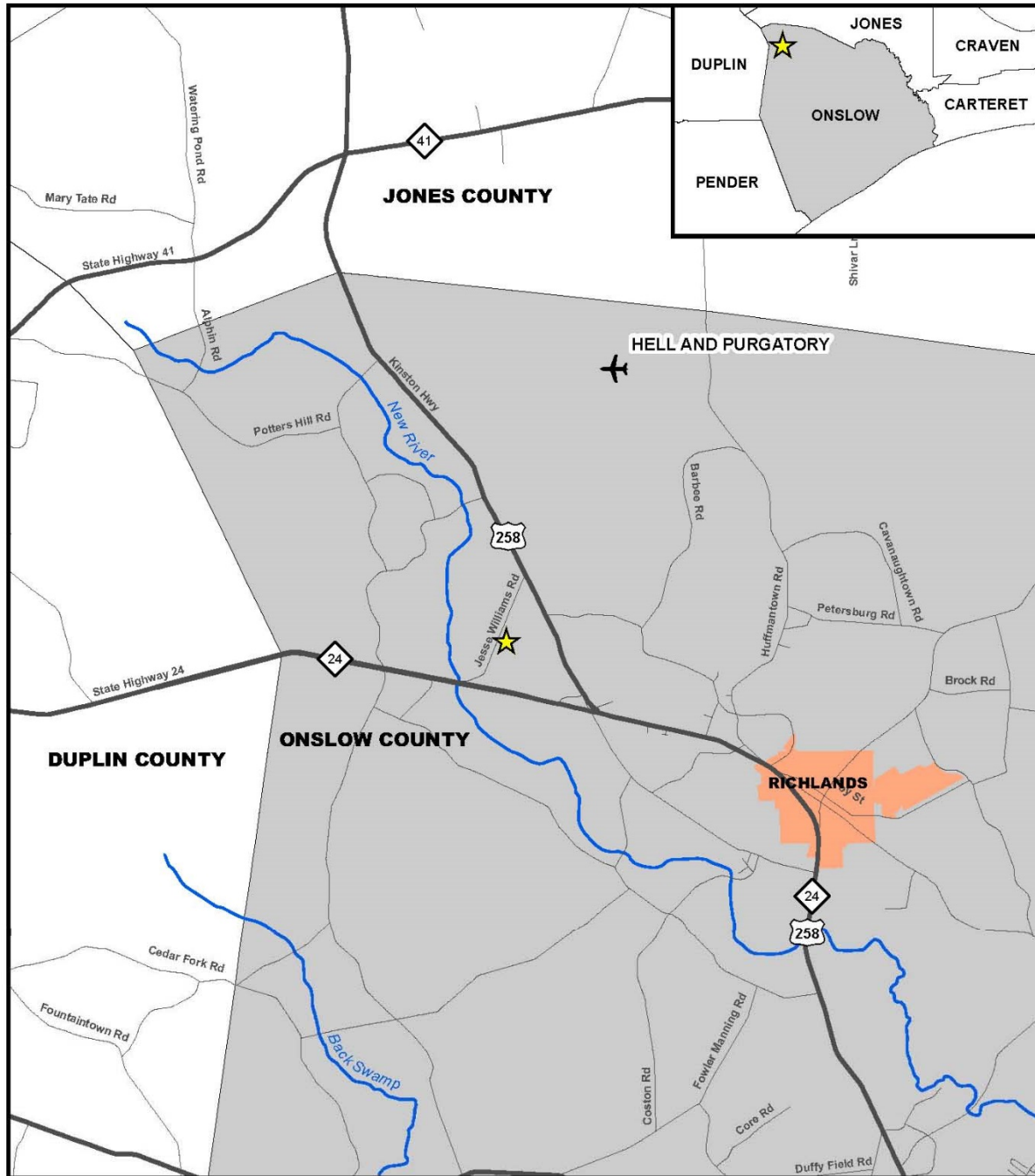
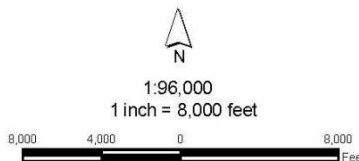


Figure 1. Vicinity Map



- ★ Project Site Location
- Major Roads
- Other Roads
- Major Rivers and Streams
- Cities and Towns
- ✈ Airports within 5 miles



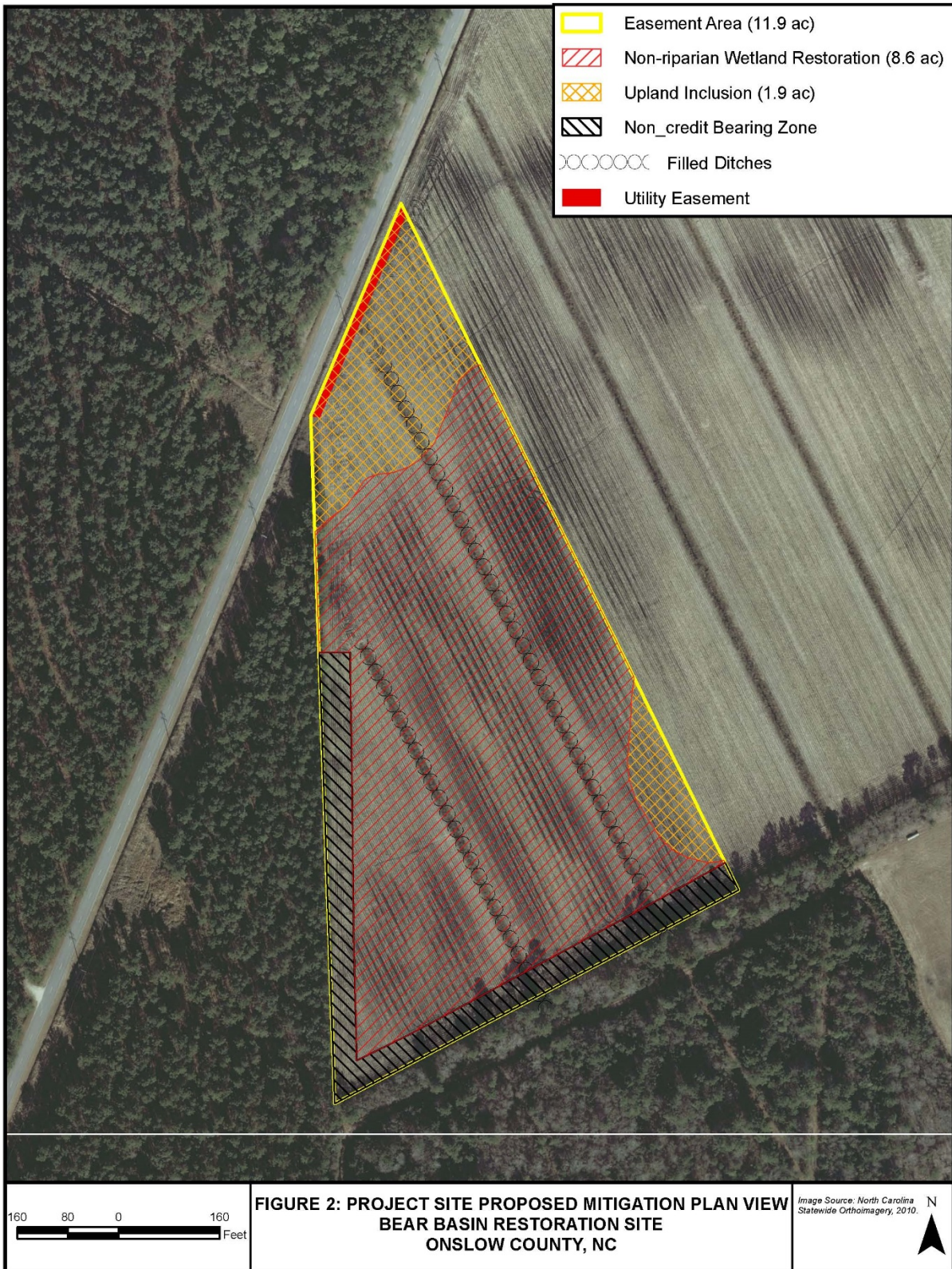


Table 1. Project Components									
Project Number and Name: 95362 – Bear Basin Restoration Site									
Mitigation Credits									
	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Acres	-	-	-	-	8.6	-	-	-	-
Credits	-	-	-	-	8.6	-	-	-	-
TOTAL CREDITS	-		-		8.6		-	-	-
Project Components									
Project Component -or- Reach ID	Stationing/ Location		Existing Footage/ Acreage		Approach (PI, PII etc.)		Restoration -or- Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio
Wetland Area	-		8.6 acres		-		Restoration	8.6 acres	1:1
Component Summation									
Restoration Level	Stream (linear feet)		Riparian Wetland (acres)		Non-riparian Wetland (acres)		Buffer (square feet)	Upland (acres)	
			Riverine	Non-Riverine					
Restoration	-		-	-	8.6 acres		-	-	
Enhancement			-	-	-		-	-	
Enhancement I	-								
Enhancement II	-								
Creation			-	-	-			-	
Preservation	-		-	-	-			1.9 acres	
High Quality Preservation	-		-	-	-			-	
TOTAL	-		-	-	8.6 acres			1.9 acres	

Table 2. Project Activity & Reporting History		
Bear Basin Wetland Restoration Site, DMS Project# 95362		
Activity or Report	Data Collection Complete	Actual Completion or Delivery
Mitigation Plan		July 2014
Final Design – Construction Plans		July 2014
Construction		Dec 2014
Planting		March 2015
Baseline Monitoring/Report	May 2015	June 2015
Vegetation Monitoring	May 19, 2015	
Photo Points	May 26, 2015	
Year 1 Monitoring	Nov 2015	Jan 2015
Vegetation Monitoring	Oct 13, 2015	
Photo Points	Oct 13, 2015	
Gauge Downloads	Nov 25, 2015	
Year 2 Monitoring	Dec 2016	Dec 2016
Vegetation Monitoring	July 5, 2016	
Photo Points	Aug 16, 2016	
Gauge Downloads	Dec 14, 2016	
Year 3 Monitoring	Nov 2017	Jan 2018
Vegetation Monitoring	July 5, 2017	
Photo Points	Nov 30, 2017	
Gauge Downloads	Nov 30, 2017	
Year 4 Monitoring	Nov 2018	Jan 2018
Vegetation Monitoring	N/A	
Photo Points	Nov 13, 2018	
Gauge Downloads	Nov 13, 2018	
Year 5 Monitoring	Nov 2019	Dec 2019
Vegetation Monitoring	July 25, 2019	
Photo Points	Nov 20, 2019	
Gauge Downloads	Nov 20, 2019	

Table 3. Project Contacts	
Project Number and Name: 95362 - Bear Basin Restoration Site	
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, Inc. 4505 Falls of Neuse Rd. Suite 400 Raleigh, NC 27609 Contact: Mr. Tim Morris Phone: (919) 278-2512 Fax: (919) 783-9266
Planting Contractor	Bruton Nurseries and Landscapes PO Box 1197 Freemont, NC 27830 Contact: Mr. Charlie Bruton Phone: (919) 242-6555
Monitoring Performers	
MY00-MY03	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 4. Project Attribute Table			
Project Number and Name: 95362 – Bear Basin Restoration Site			
County	Onslow County		
Project Area (acres)	11.9 acres		
Project Coordinates (lat. and long.)	34.925365 N , -77.607461 W		
Project Watershed Summary Information			
Physiographic Province	Coastal Plain		
River Basin	White Oak		
USGS Hydrologic Unit 8-digit	03030001	USGS Hydrologic Unit 14-digit	03030001010010
DWQ Sub-basin	03-05-02b		
Project Drainage Area (acres)	32.7 acres		
Project Drainage Area Percentage of Impervious Area	2%		
CGIA Land Use Classification	44% Cultivated, 4% Managed Herbaceous Cover, 50% Southern Yellow Pine, and 2% High-Intensity Developed		
Wetland Summary Information			
Parameters	Wetland Area		
Size of Wetland (acres)	8.6 acres		
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)	Non-riparian		
Mapped Soil Series	Rains and Stallings (Pantego and Lynchburg by detailed soil investigation)		
Drainage class	Poorly drained		
Soil Hydric Status	Drained Hydric		
Source of Hydrology	Precipitation		
Hydrologic Impairment	Ditching and Crops		
Native vegetation community	Crops		
Percent composition of exotic invasive vegetation	0%		

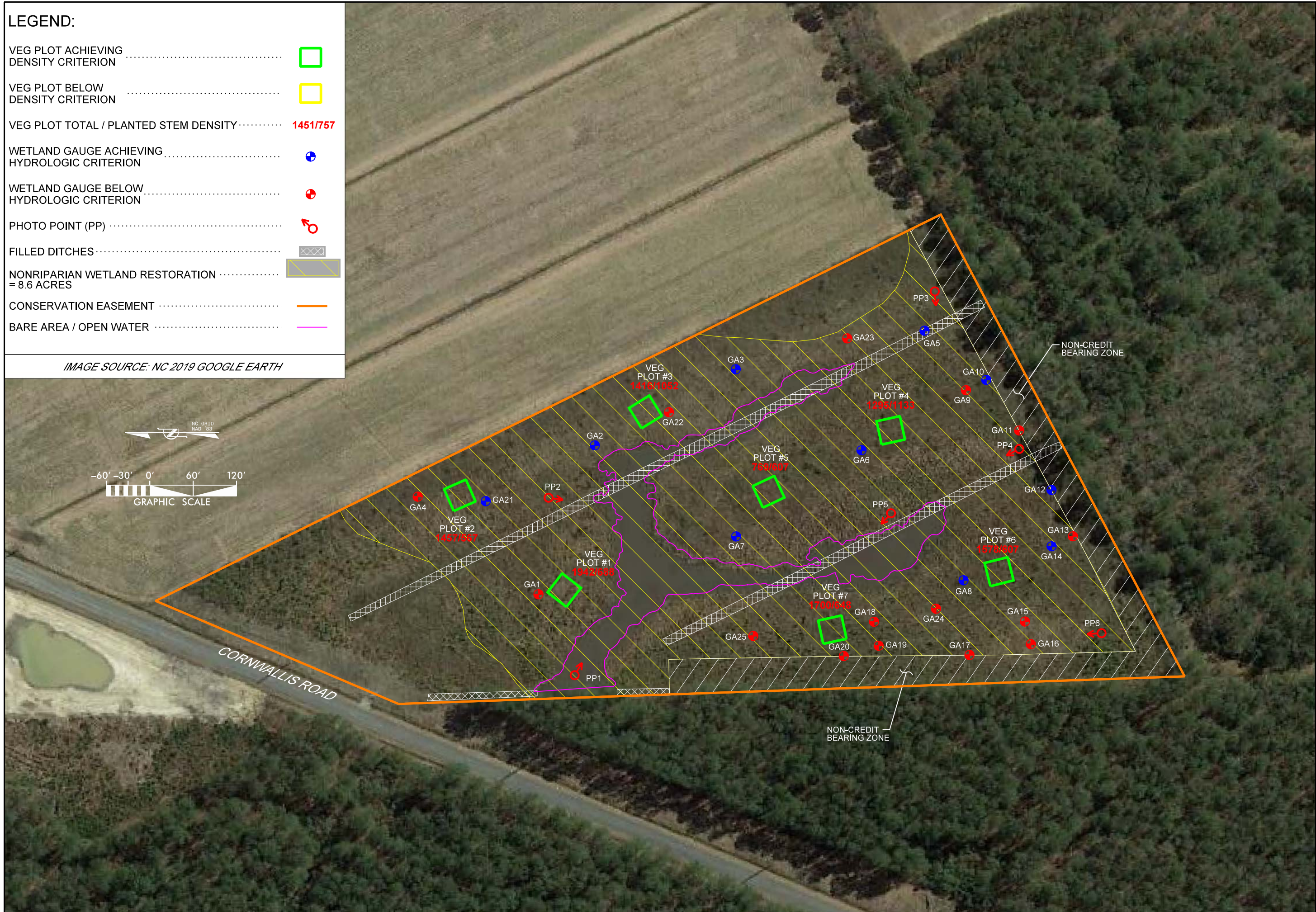
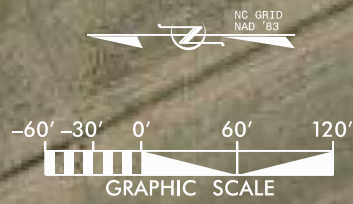
Appendix B

Visual Assessment Data

LEGEND:

- VEG PLOT ACHIEVING DENSITY CRITERION □
- VEG PLOT BELOW DENSITY CRITERION □
- VEG PLOT TOTAL / PLANTED STEM DENSITY **1451/757**
- WETLAND GAUGE ACHIEVING HYDROLOGIC CRITERION ●
- WETLAND GAUGE BELOW HYDROLOGIC CRITERION ●
- PHOTO POINT (PP) ♂
- FILLED DITCHES
- NONRIPARIAN WETLAND RESTORATION = 8.6 ACRES
- CONSERVATION EASEMENT —
- BARE AREA / OPEN WATER —

IMAGE SOURCE: NC 2019 GOOGLE EARTH



<p>NCDEQ DIVISION OF MITIGATION SERVICES</p>	<p>KCI ASSOCIATES OF NC ENGINEERS • PLANNERS • SCIENTISTS 4505 FALLS OF NEUSE ROAD RALEIGH, NORTH CAROLINA 27609</p>
<p>BEAR BASIN RESTORATION SITE DMS PROJECT #95362 RICHLANDS, ONSLOW COUNTY, NORTH CAROLINA MONITORING YEAR 05</p>	<p>DATE: DEC 2019 SCALE: GRAPHIC</p>
<p>CURRENT CONDITION PLAN VIEW</p>	
<p>SHEET 1 OF 1</p>	
<p>FIGURE 3</p>	

Table 5. Vegetation Condition Assessment						
Project Number and Name: 95362 – Bear Basin Restoration Site						
Planted Acreage 11.9			Easement Acreage 8.6			
Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	1	0.87	7.3%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	0	0.00	0.0%
Total				1	0.87	7.3%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
Cumulative Total				1	0.87	7.3%
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1000 SF	Pattern and Color	0	0.00	0.0%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	none	Pattern and Color	0	0.00	0.0%

Photo Reference Points



PP1 – MY-00 – 5/26/15



PP1 – MY-05 – 11/20/19



PP2 – MY-00 – 5/26/15



PP2 – MY-05 – 11/20/19



PP3 – MY-00 – 5/26/15



PP3 – MY-05 – 11/20/19



PP4 – MY-00 – 5/26/15



PP4 – MY-05 – 11/20/19



PP5 – MY-00 – 5/26/15



PP5 – MY-05 – 11/20/19



PP6 – MY-00 – 5/26/15



PP6 – MY-05 – 11/20/19

Vegetation Monitoring Plot Photos



Vegetation Plot 1 – MY-05 – 7/22/19



Vegetation Plot 2 – MY-05 – 7/22/19



Vegetation Plot 3 – MY-05 – 7/22/19



Vegetation Plot 4 – MY-05 – 7/22/19



Vegetation Plot 5 – MY-05 – 7/22/19



Vegetation Plot 6 – MY-05 – 7/25/19



Vegetation Plot 7 – MY-05 – 7/25/19

Open Water Area Extent Throughout the Year



January 10, 2019



February 10, 2019



March 10, 2019



April 10, 2019



May 10, 2019



June 10, 2019



July 10, 2019



August 10, 2019



September 10, 2019



October 10, 2019



November 10, 2019

Appendix C

Vegetation Plot Data

Table 6. Vegetation Plot Criteria Attainment

Project Number and Name: 95362 - Bear Basin Restoration Site

Vegetation Plot ID	Vegetation Survival Threshold Met? (320 planted stems/acre)	Monitoring Year 05 Planted Stem Density (stems/acre)	Monitoring Year 05 Total Stem Density (stems/acre)
1	Yes	688	1942
2	Yes	567	1457
3	Yes	1052	1416
4	Yes	1133	1295
5	Yes	607	769
6	Yes	607	1578
7	Yes	648	1700

Table 7. CVS Vegetation Plot Metadata	
Project Number and Name: 95362 - Bear Basin Wetland Restoration Site	
Report Prepared By	Angela Gutierrez
Date Prepared	7/30/2019 15:21
database name	KCI-2015-95362_Bear Basin.mdb
database location	M:\2012\20122266_BearBasin\Monitoring\Veg Database
computer name	12-3ZV4FP1
file size	61739008
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	95362
project Name	Bear Basin
Description	Wetland Restoration Site
River Basin	White Oak
Sampled Plots	7

Table 8. CVS Stem Count by Plot and Species

EEP Project Code 95362. Project Name: Bear Basin

Scientific Name	Common Name	Species Type	Current Plot Data (MY5 2019)																				
			95362-01-0001			95362-01-0002			95362-01-0003			95362-01-0004			95362-01-0005			95362-01-0006			95362-01-0007		
			Pno	LS	P-all	Pno	LS	P-all	Pno	LS	P-all	Pno	LS	P-all	Pno	LS	P-all	Pno	LS	P-all	Pno	LS	P-all
Acer rubrum	red maple	Tree						1			1			3						4			1
Aronia arbutifolia	Red Chokeberry	Shrub							1	1	1							1	1	1	1	1	1
Baccharis	baccharis	Shrub																					
Baccharis halimifolia	eastern baccharis	Shrub						2												1			
Betula nigra	river birch	Tree	1	1	1				4	4	4							1	1	1			
Celtis occidentalis	common hackberry	Tree																					
Cephalanthus occidentalis	common buttonbush	Shrub							1	1	1										1	1	1
Diospyros virginiana	common persimmon	Tree				5	5	5															
Fraxinus pennsylvanica	green ash	Tree	5	5	5				3	3	3												
Juglans nigra	black walnut	Tree						2									1			1			
Liquidambar styraciflua	sweetgum	Tree			4			3			3									6			1
Liriodendron tulipifera	tuliptree	Tree										3	3	3	4	4	4						
Magnolia virginiana	sweetbay	Tree	2	2	2				4	4	4	1	1	1				1	1	1			
Morella cerifera	wax myrtle	shrub			1			1															
Nyssa biflora	swamp tupelo	Tree	3	3	3																1	1	1
Pinus palustris	longleaf pine	Tree																					
Pinus taeda	loblolly pine	Tree			25			13			5			1			2			12			23
Quercus	oak	Tree																					
Quercus laurifolia	laurel oak	Tree	1	1	1				2	2	2							2	2	2			
Quercus nigra	water oak	Tree																					
Quercus pagoda	cherrybark oak	Tree	4	4	4	9	9	9	9	9	9	24	24	24	4	4	4	4	4	4	11	11	12
Quercus phellos	willow oak	Tree	1	1	1				1	1	1				7	7	8	2	2	2	2	2	2
Salix nigra	black willow	Tree			1																		
Taxodium distichum	bald cypress	Tree							1	1	1							2	2	2			
Vaccinium corymbosum	highbush blueberry	Shrub																2	2	2			
		Stem count	17	17	48	14	14	36	26	26	35	28	28	32	15	15	19	15	15	39	16	16	42
		size (ares)	1			1			1			1			1			1					
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02					
		Species count	7	7	11	2	2	8	9	9	12	3	3	5	3	3	5	8	8	13	5	5	8
		Stems per ACRE	688	688	1942	566.6	566.6	1457	1052	1052	1416	1133	1133	1295	607	607	768.9	607	607	1578	647.5	647.5	1700

Table 8. CVS Stem Count by Plot and Species

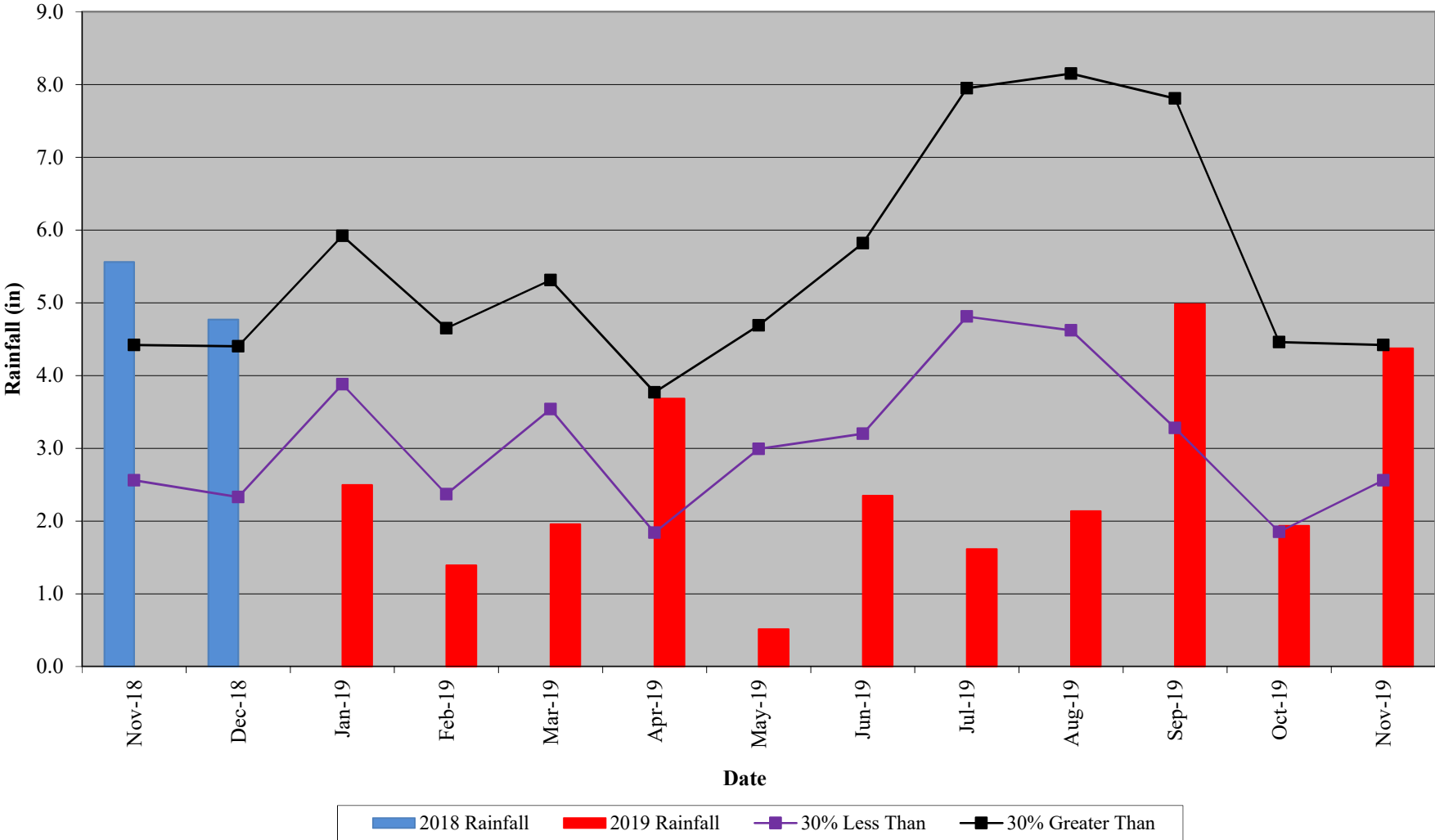
EEP Project Code 95362. Project Name: Bear Basin

Scientific Name	Common Name	Species Type	Annual Means														
			MY5 (2019)			MY3 (2017)			MY2 (2016)			MY1 (2015)			MY0 (2015)		
			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			10			2									
Aronia arbutifolia	Red Chokeberry	Shrub	3	3	3	4	4	4	3	3	3	4	4	4	4	4	
Baccharis	baccharis	Shrub									2						
Baccharis halimifolia	eastern baccharis	Shrub			3			1									
Betula nigra	river birch	Tree	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
Celtis occidentalis	common hackberry	Tree							1	1	1						
Cephalanthus occidentalis	common buttonbush	Shrub	2	2	2	2	2	2	1	1	1	1	1	1	1	1	
Diospyros virginiana	common persimmon	Tree	5	5	5	5	5	5	5	5	5	6	6	7	7	7	
Fraxinus pennsylvanica	green ash	Tree	8	8	8	8	8	8	8	8	8	7	7	7	8	8	
Juglans nigra	black walnut	Tree			4			1									
Liquidambar styraciflua	sweetgum	Tree			17			9			5			8			
Liriodendron tulipifera	tuliptree	Tree	7	7	7	13	13	13	9	9	10	10	10	10	15	15	
Magnolia virginiana	sweetbay	Tree	8	8	8	8	8	8	7	7	7	6	6	6	5	5	
Morella cerifera	wax myrtle	shrub			2												
Nyssa biflora	swamp tupelo	Tree	4	4	4	4	4	4	4	4	4						
Pinus palustris	longleaf pine	Tree						13									
Pinus taeda	loblolly pine	Tree			81												
Quercus	oak	Tree				1	1	1	1	1	6	3	3	4	2	2	
Quercus laurifolia	laurel oak	Tree	5	5	5												
Quercus nigra	water oak	Tree												1	1	1	
Quercus pagoda	cherrybark oak	Tree	65	65	66	66	66	66	66	66	66	64	64	68	67	67	
Quercus phellos	willow oak	Tree	13	13	14	18	18	18	16	16	16	15	15	15	16	16	
Salix nigra	black willow	Tree			1												
Taxodium distichum	bald cypress	Tree	3	3	3	3	3	3	3	3	3	1	1	1			
Vaccinium corymbosum	highbush blueberry	Shrub	2	2	2	3	3	3	3	3	3	2	2	2	2	2	
Stem count			131	131	251	141	141	167	133	133	146	125	125	139	134	134	
size (ares)			7			7			7			7			7		
size (ACRES)			0.17			0.17			0.17			0.17			0.17		
Species count			13	13	20	13	13	18	14	14	16	12	12	13	12	12	
Stems per ACRE			757	757	1451	815	815	965	769	769	844	723	723	804	775	775	

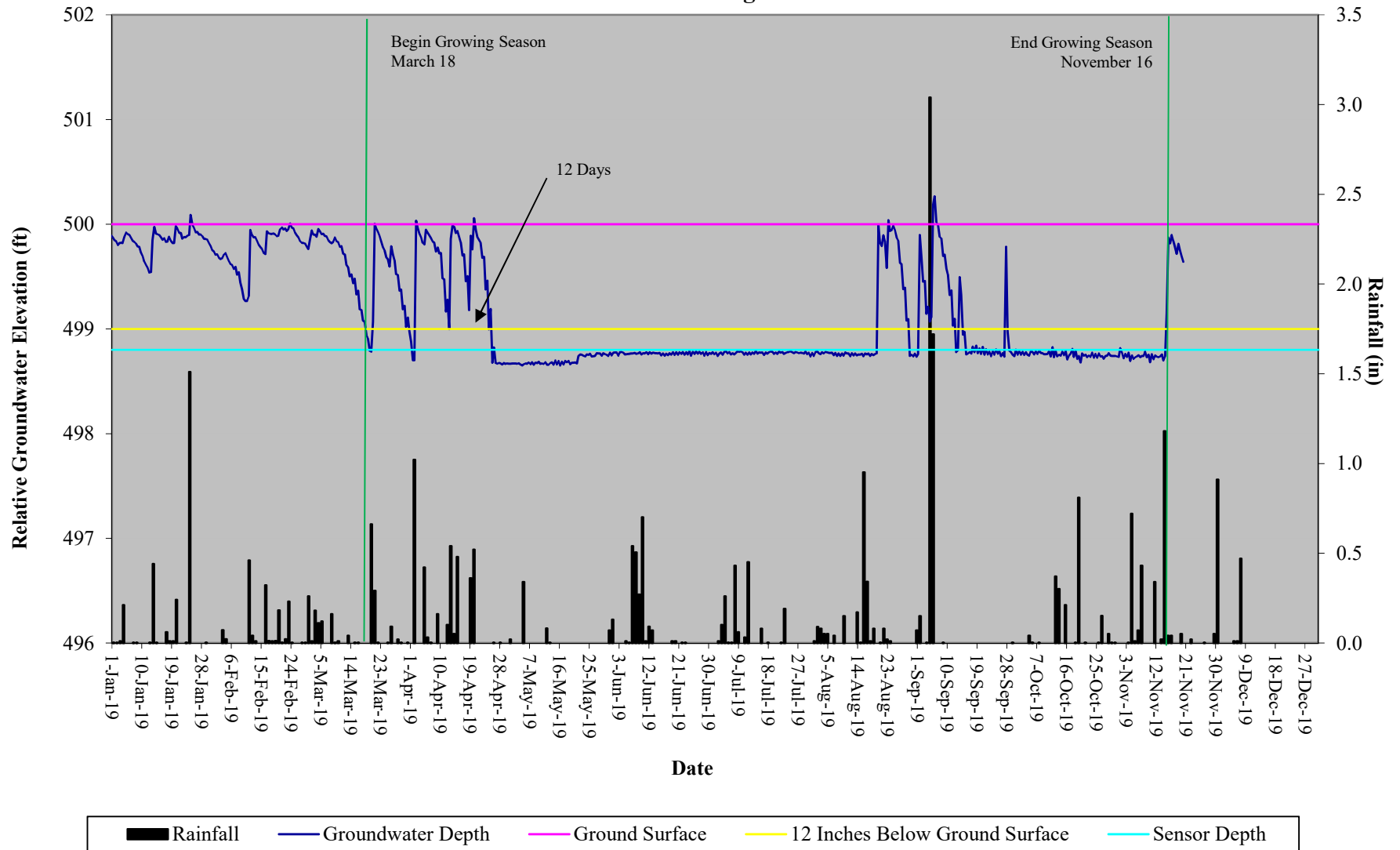
Appendix D

Hydrologic Data

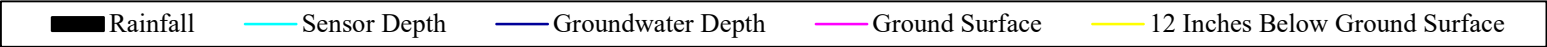
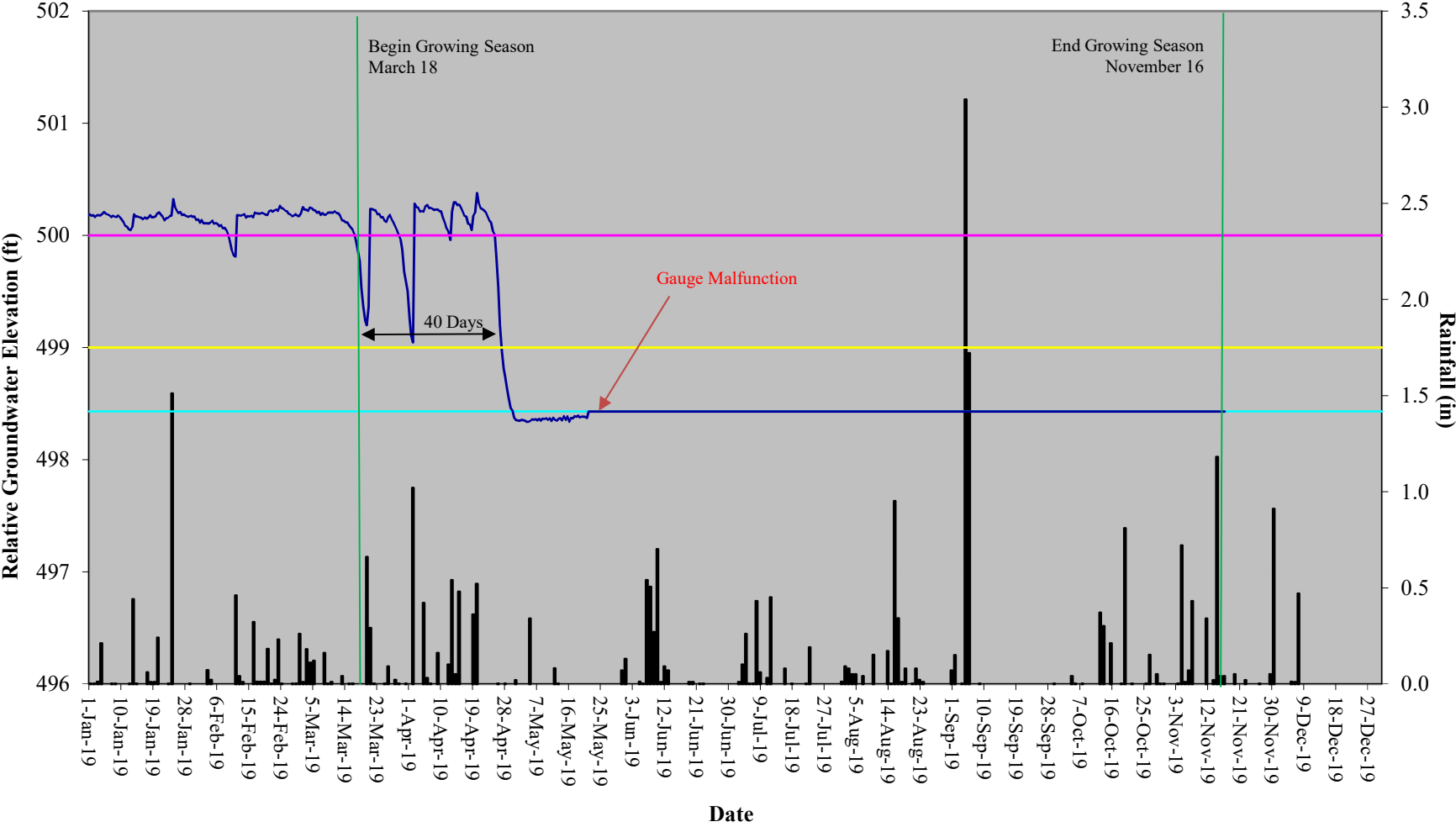
**Bear Basin Wetland Restoration Site
30-70 Percentile Graph
WETS Station Name: Maysville, NC**



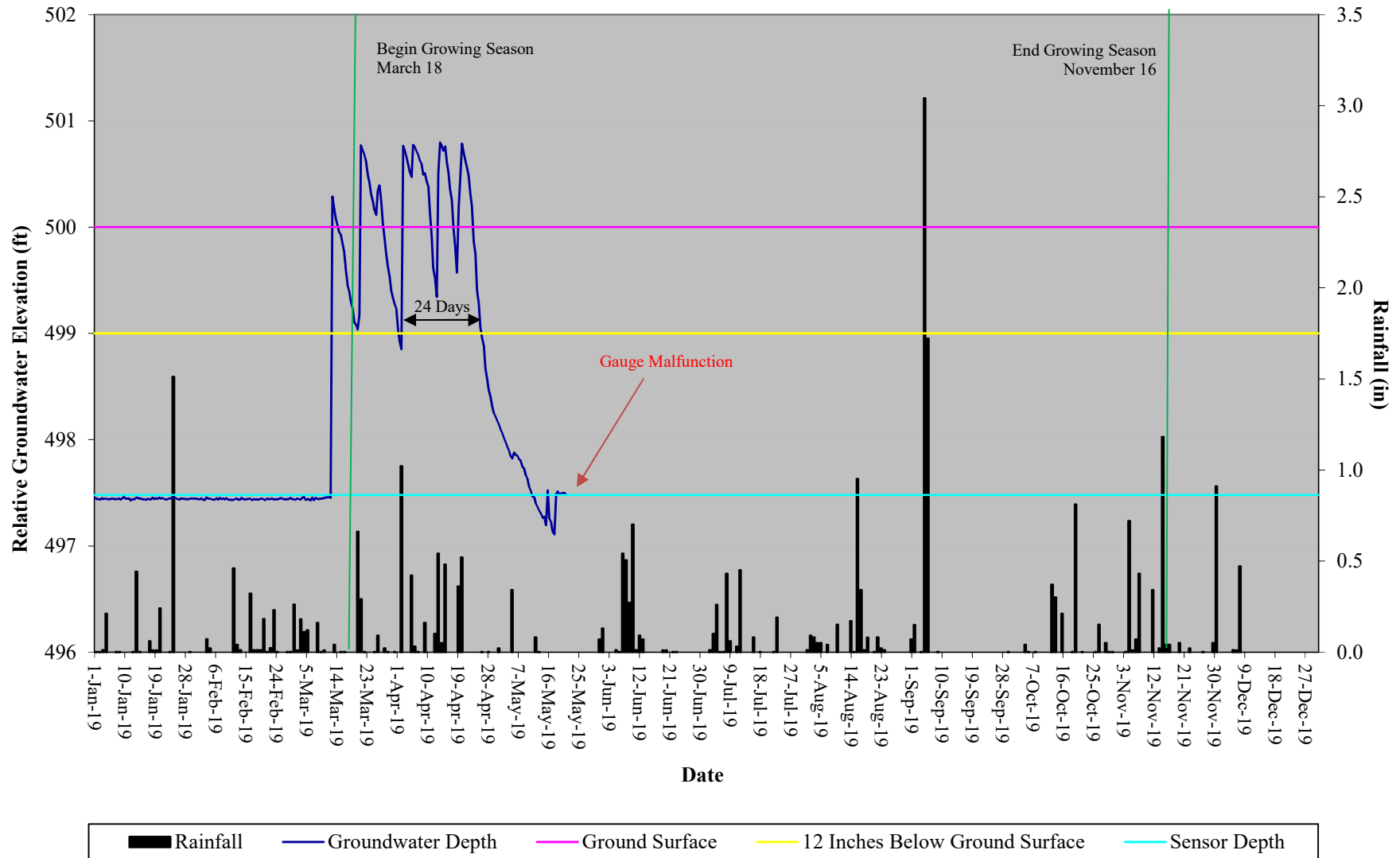
Bear Basin Restoration Site Hydrograph Wetland Gauge 1



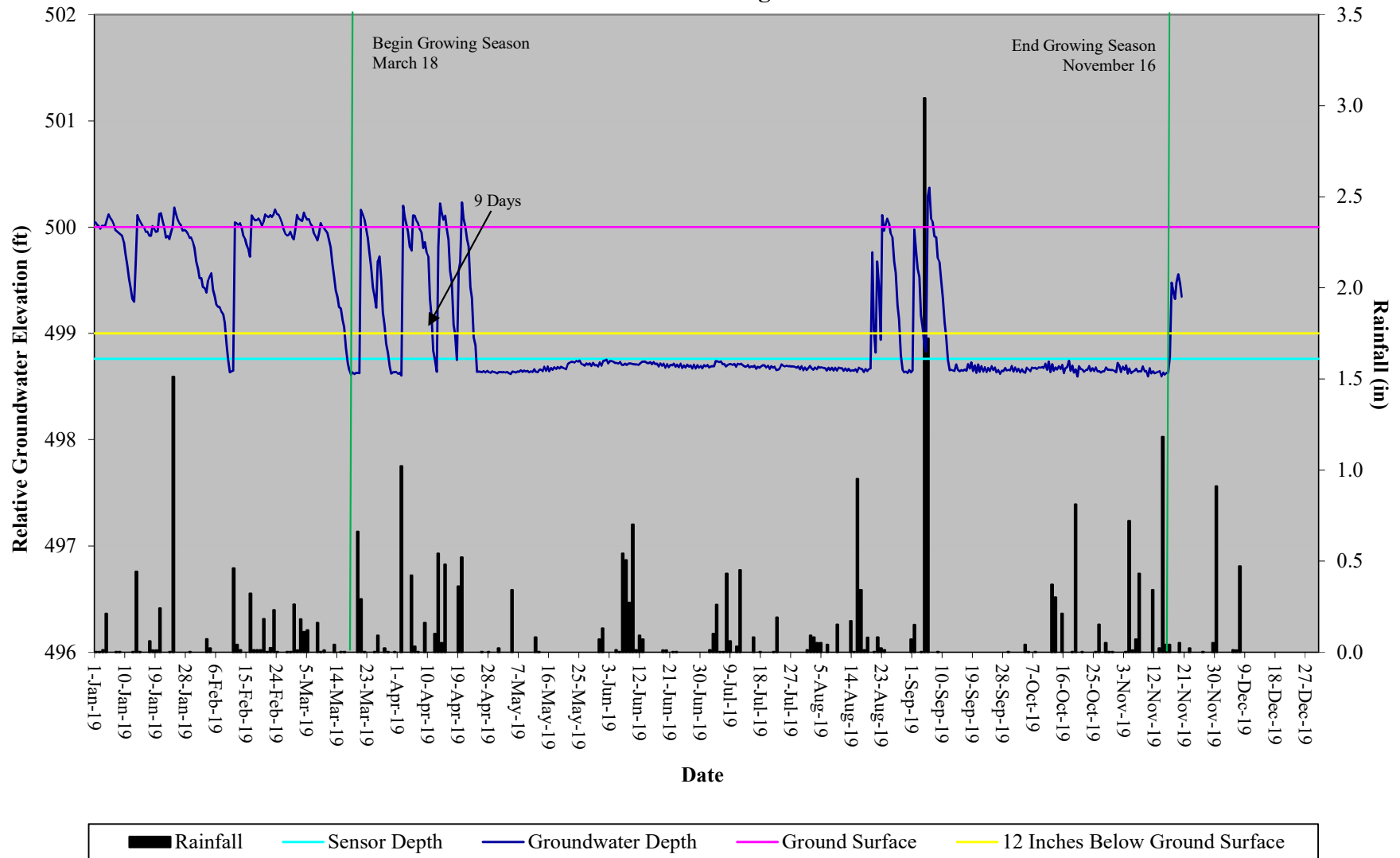
Bear Basin Restoration Site Hydrograph Wetland Gauge 2



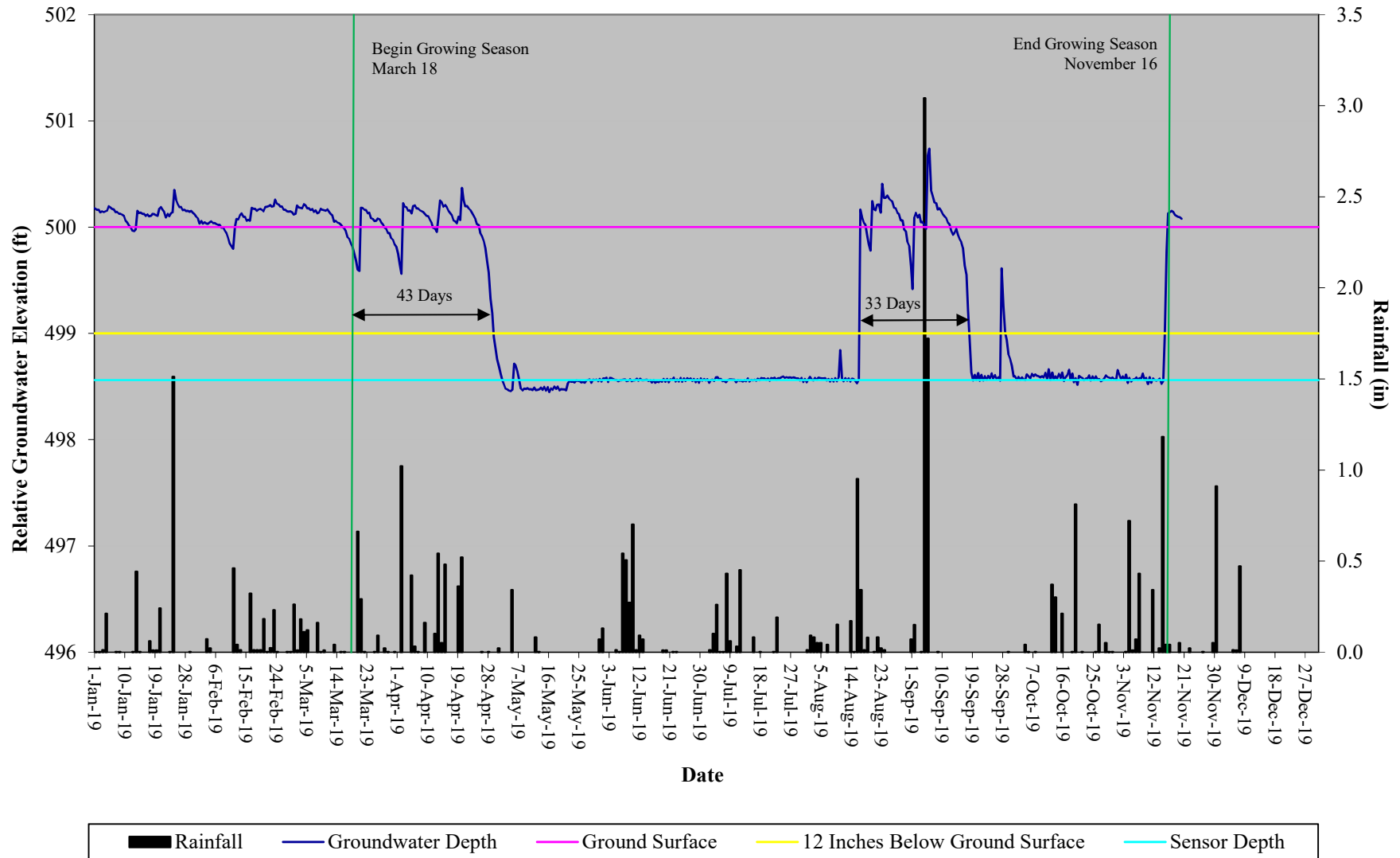
Bear Basin Restoration Site Hydrograph Wetland Gauge 3



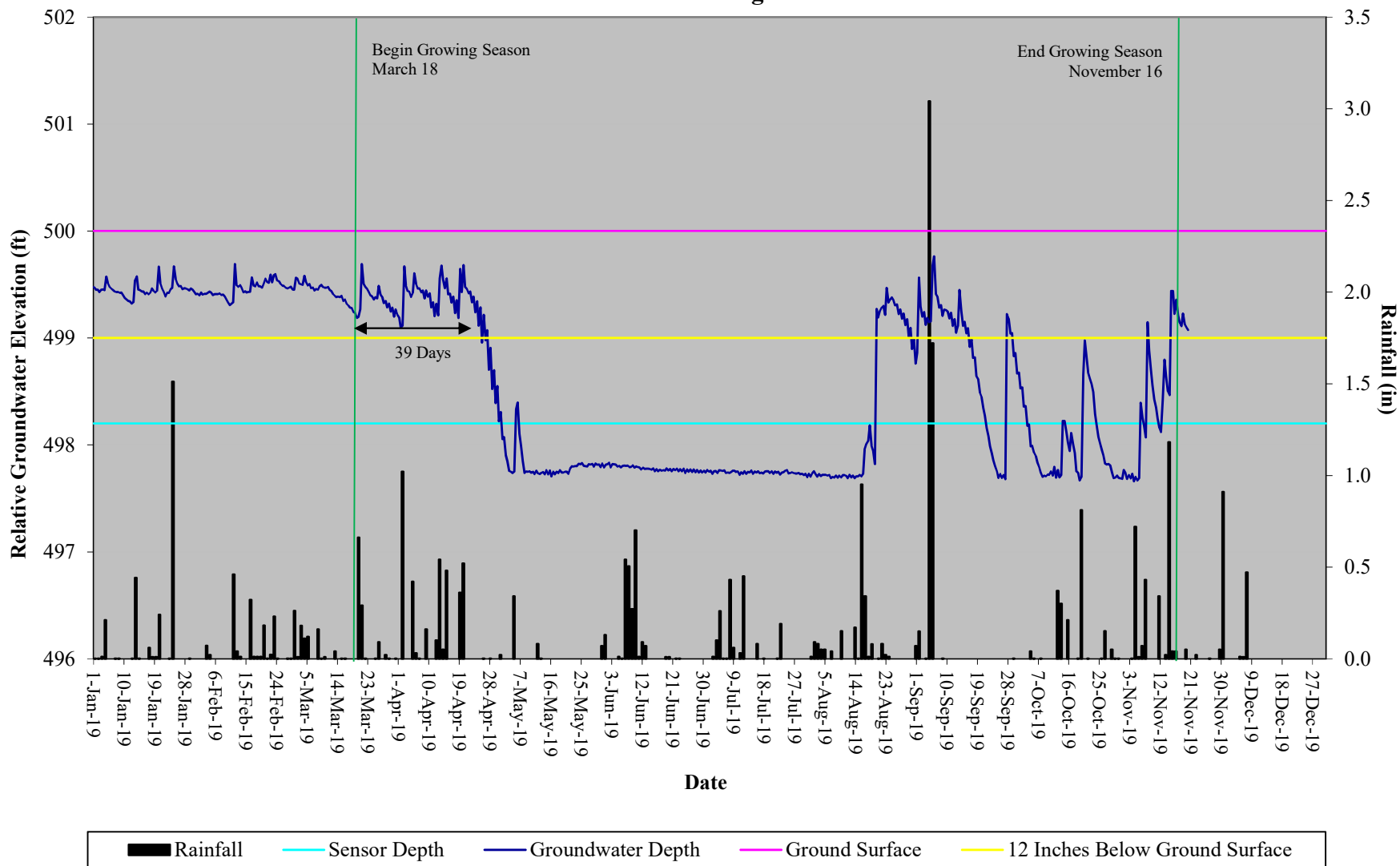
Bear Basin Restoration Site Hydrograph Wetland Gauge 4



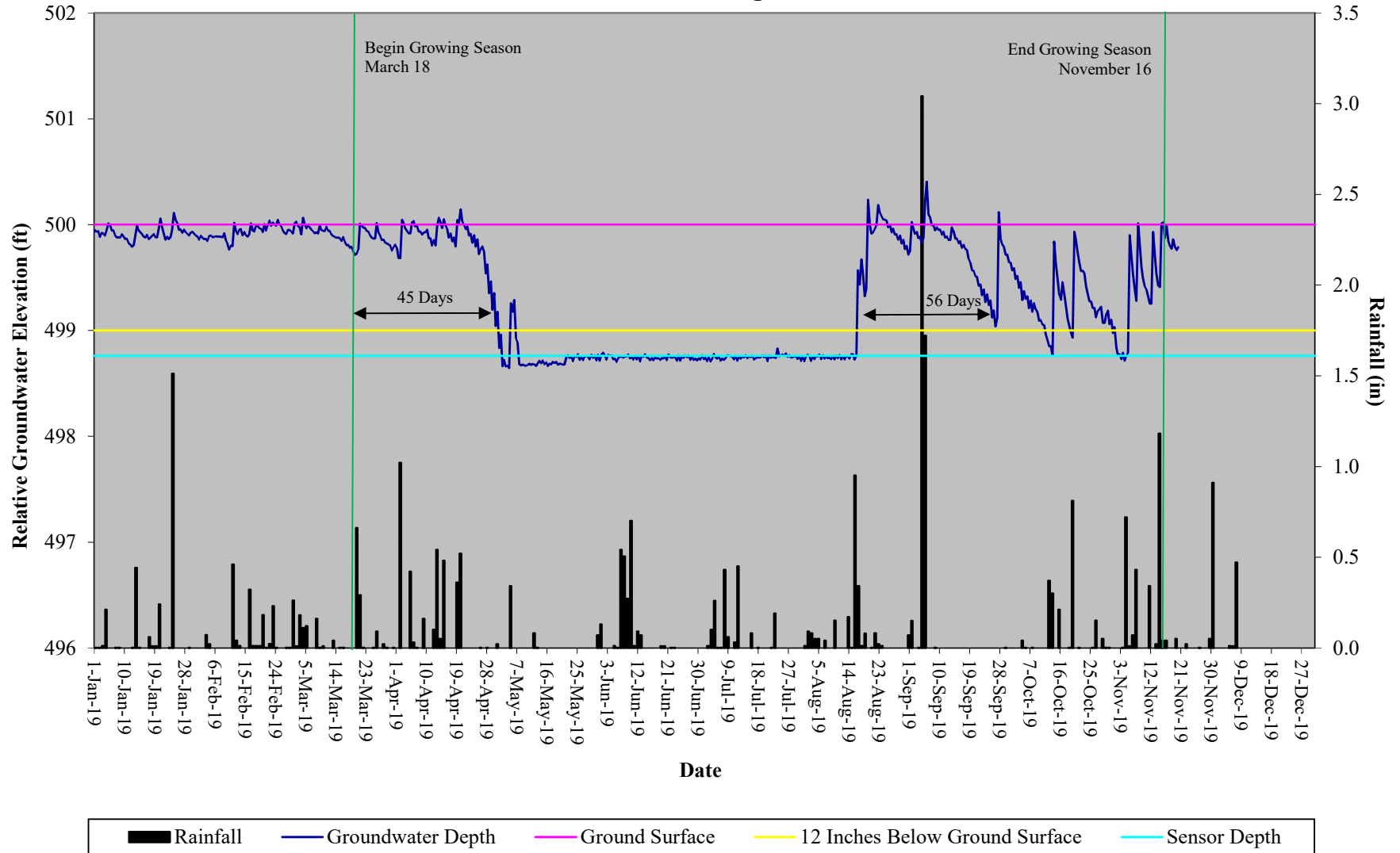
Bear Basin Restoration Site Hydrograph Wetland Gauge 5



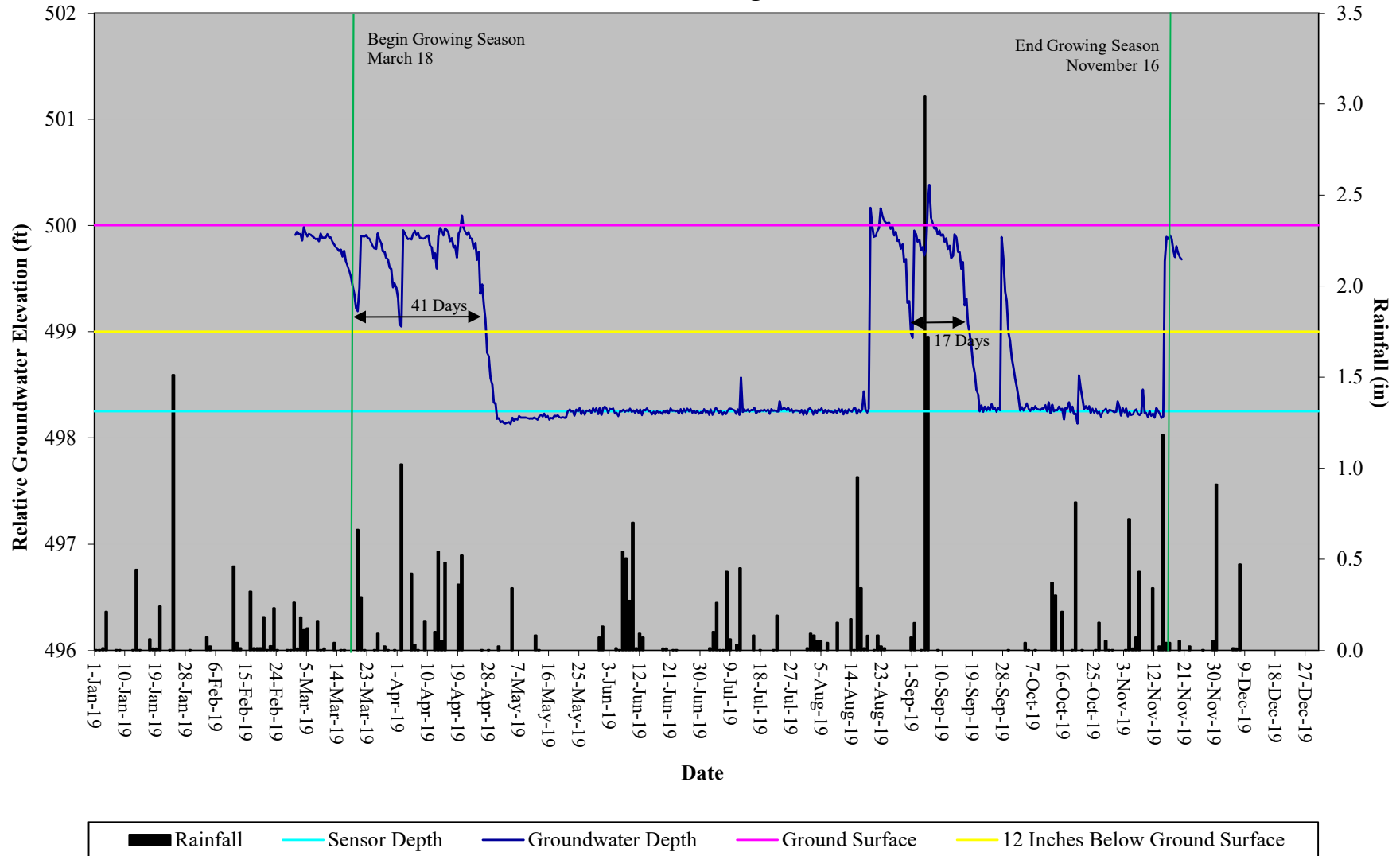
Bear Basin Restoration Site Hydrograph Wetland Gauge 6



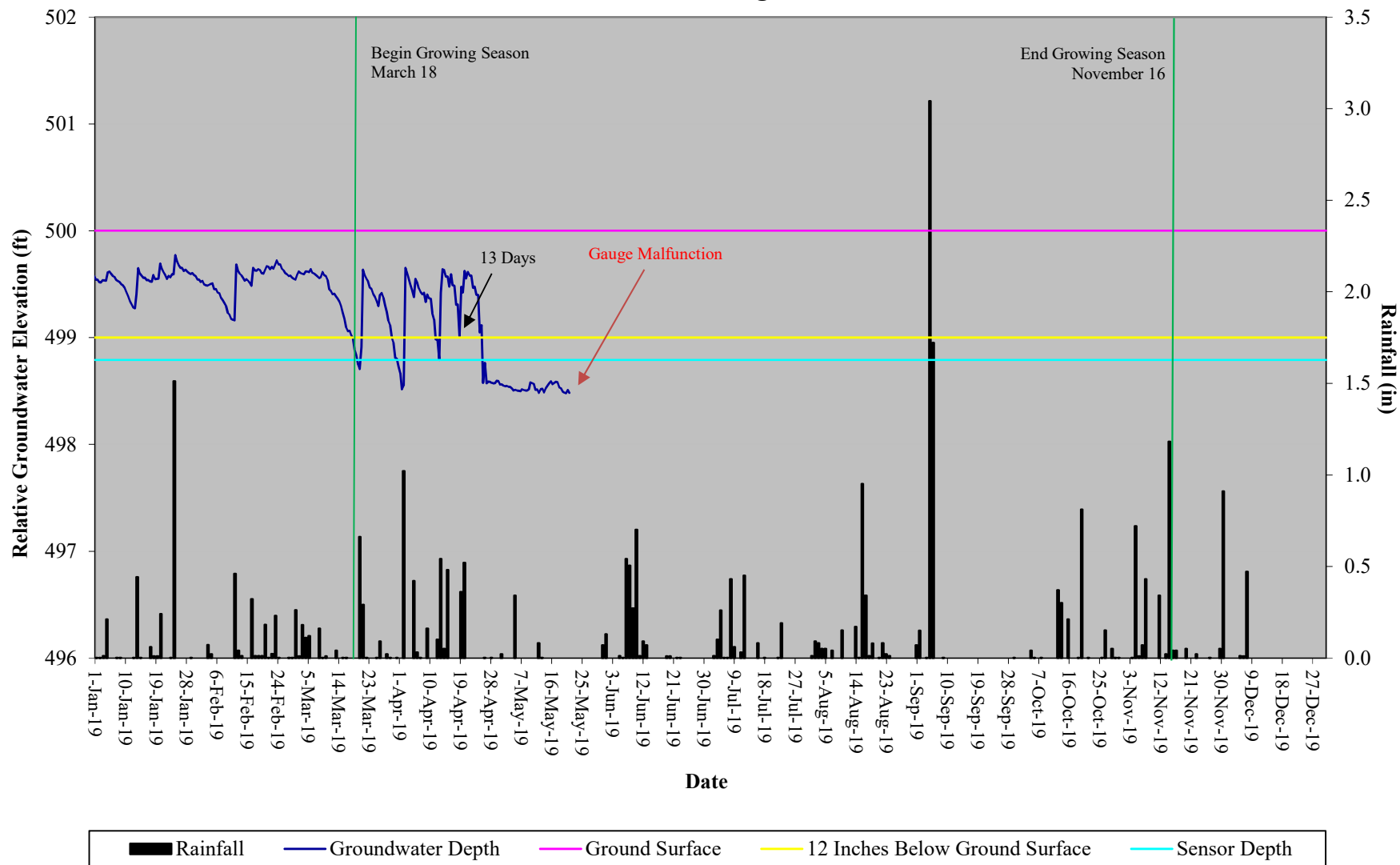
Bear Basin Restoration Site Hydrograph Wetland Gauge 7



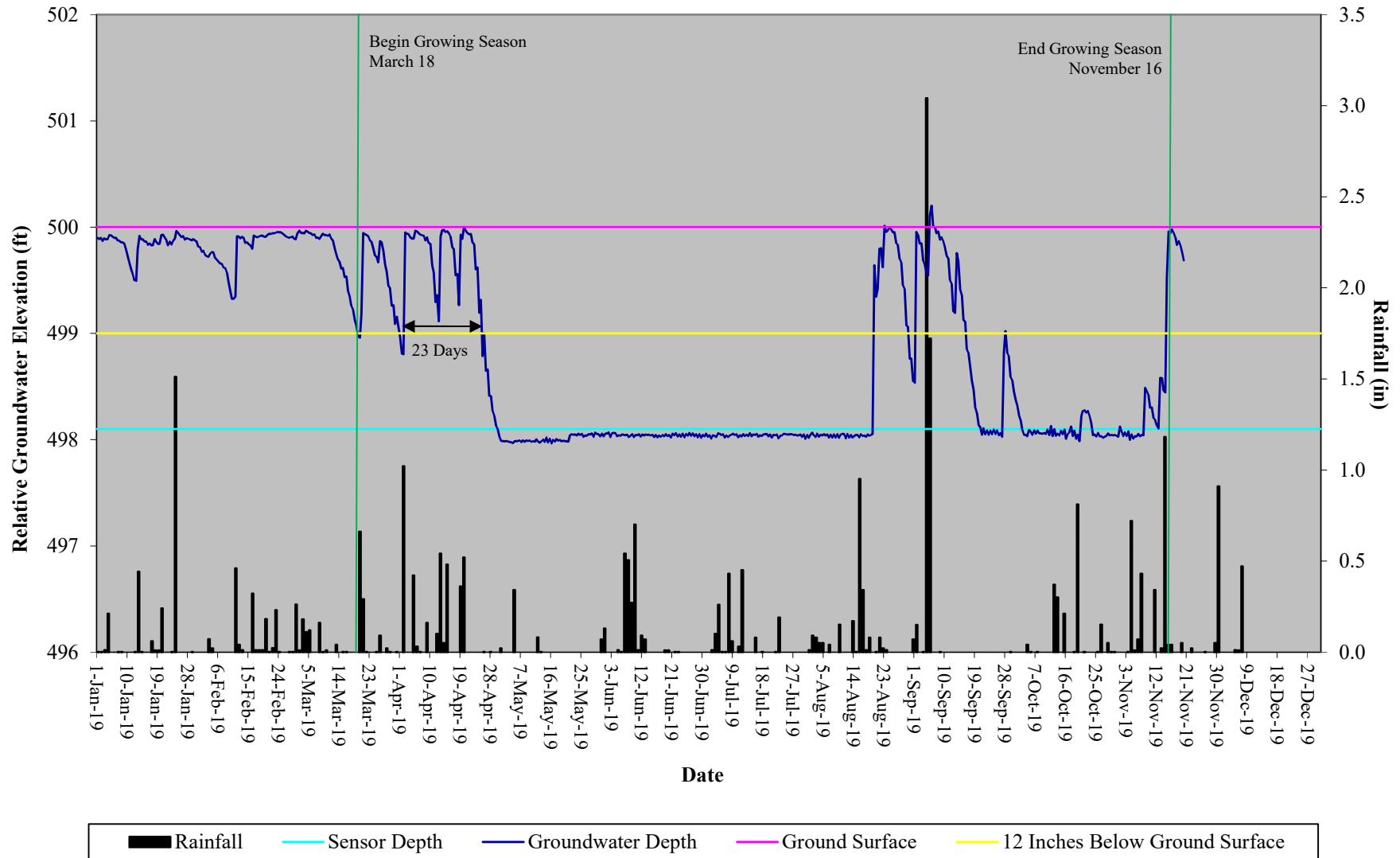
Bear Basin Restoration Site Hydrograph Wetland Gauge 8



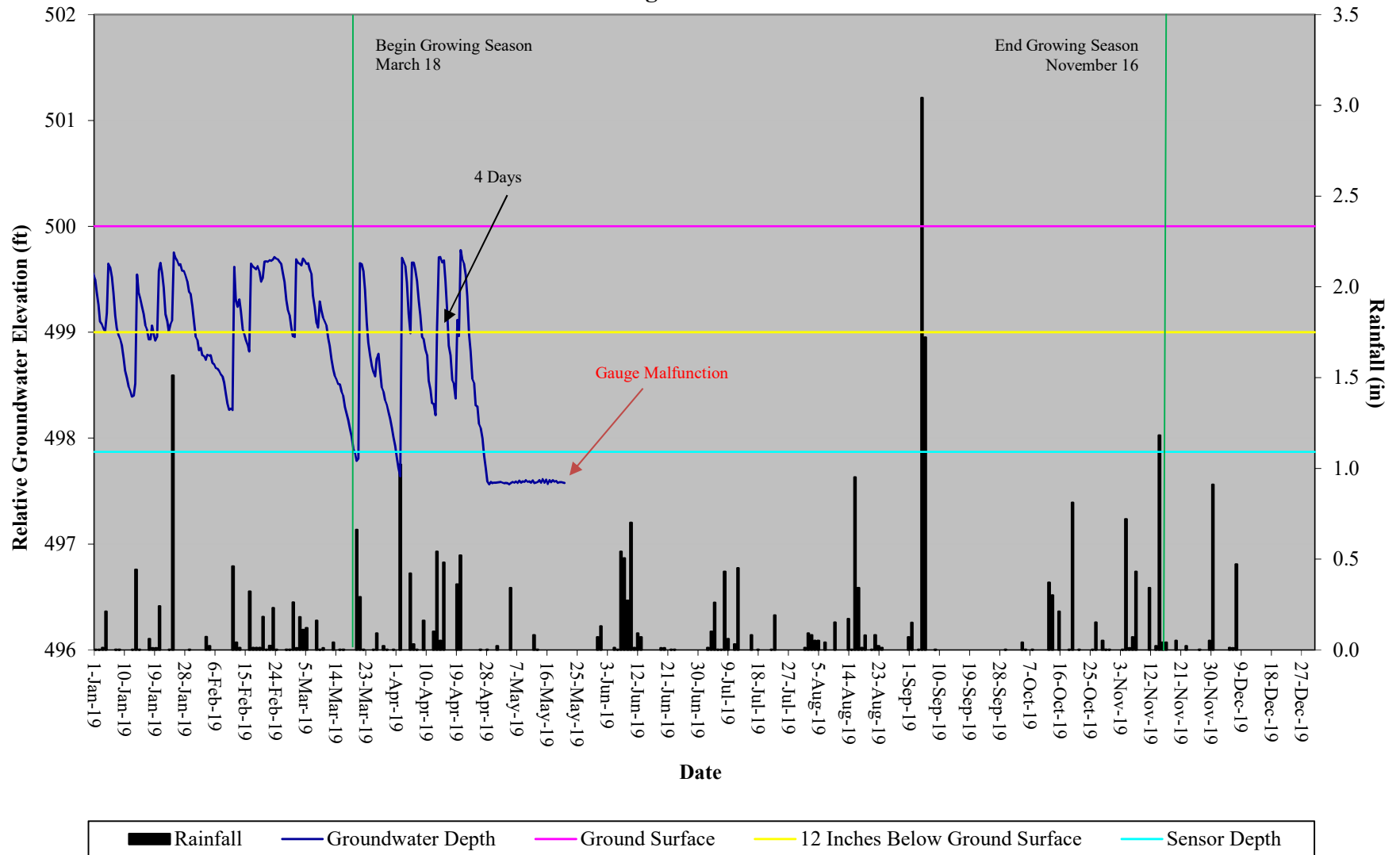
Bear Basin Restoration Site Hydrograph Wetland Gauge 9



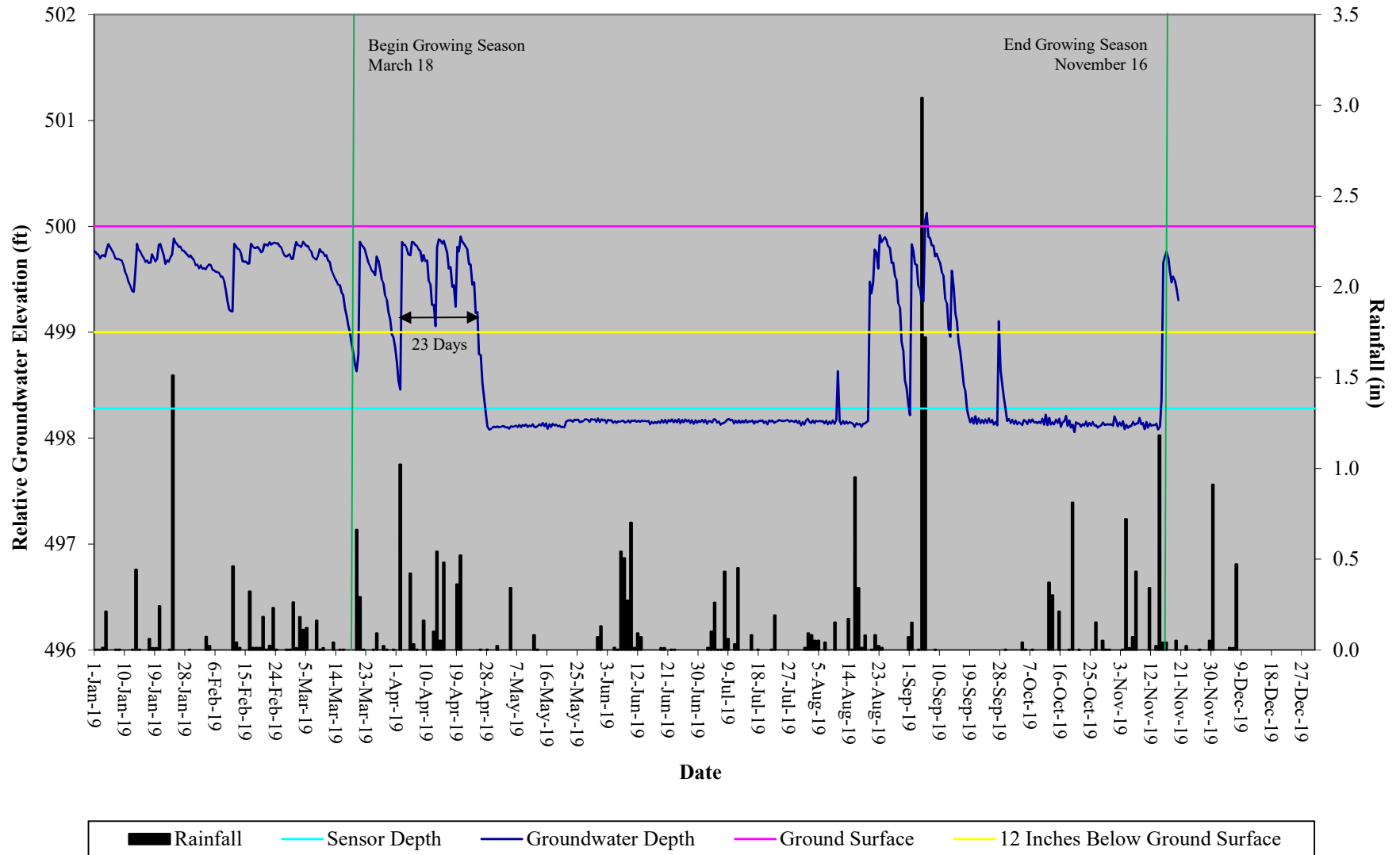
Bear Basin Restoration Site Hydrograph Wetland Gauge 10



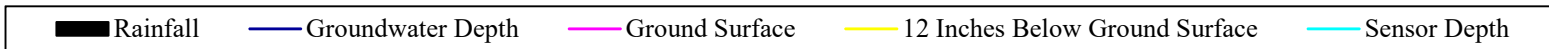
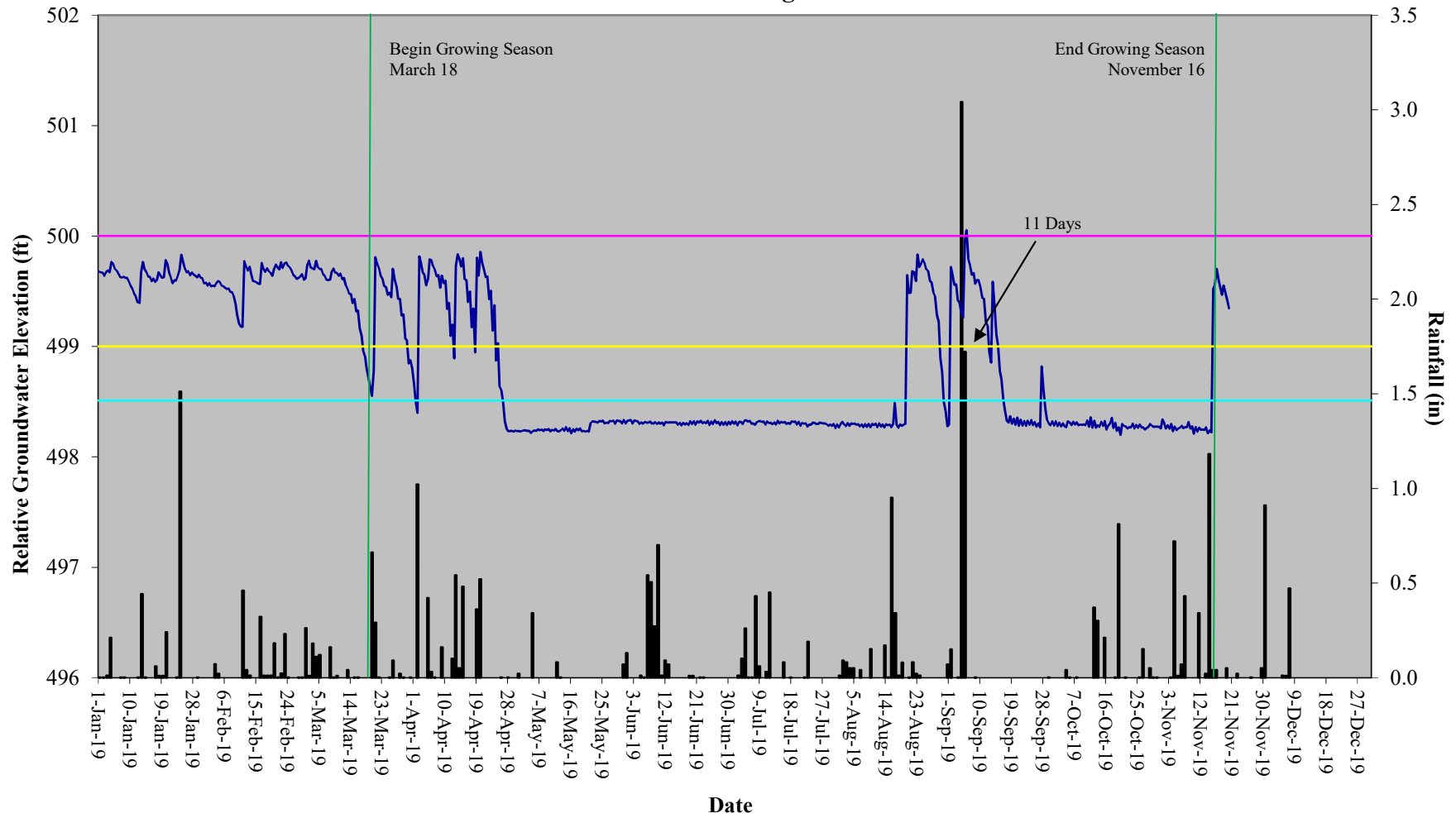
Bear Basin Restoration Site Hydrograph Wetland Gauge 11 - non-credit zone



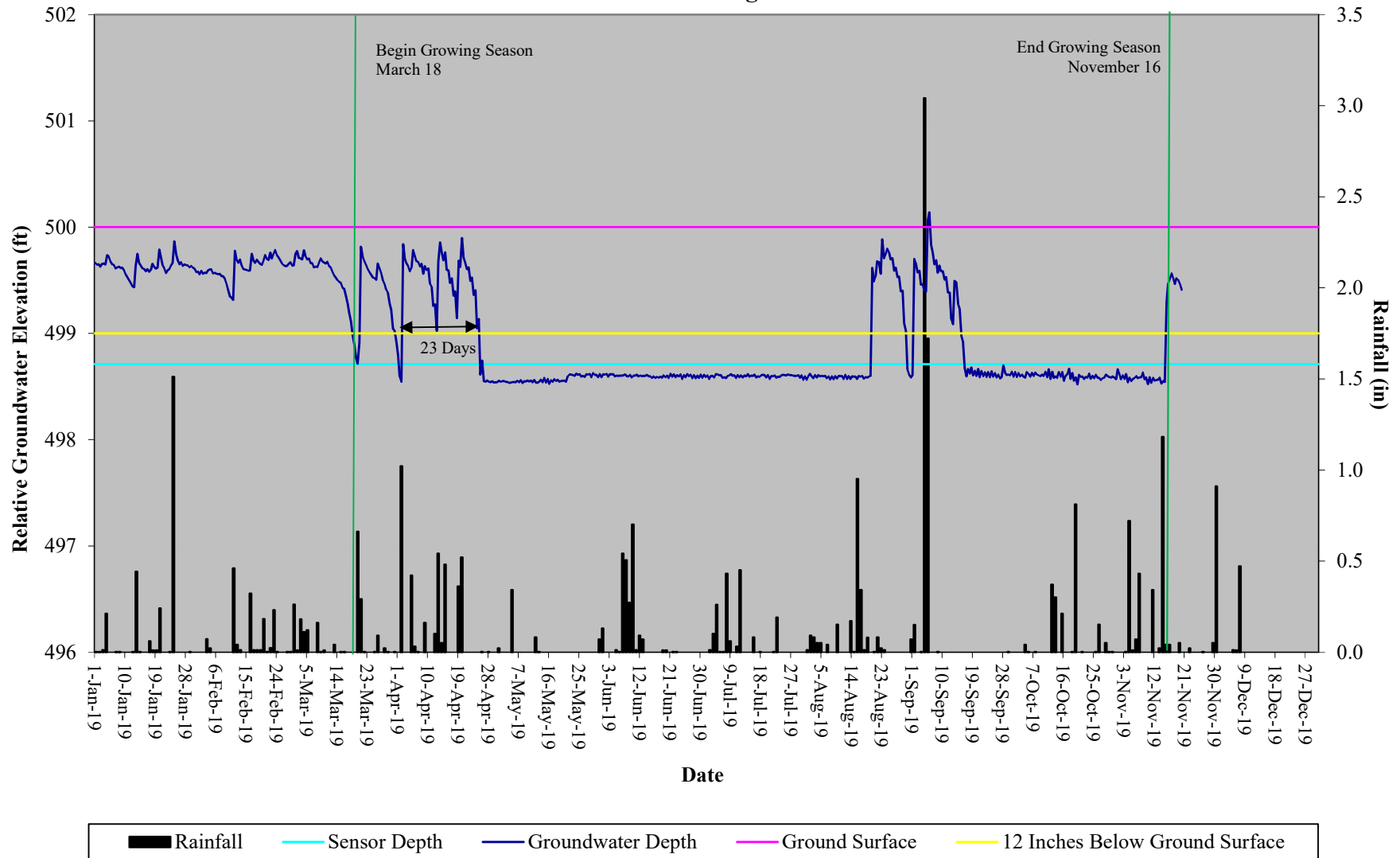
Bear Basin Restoration Site Hydrograph Wetland Gauge 12 - non-credit zone



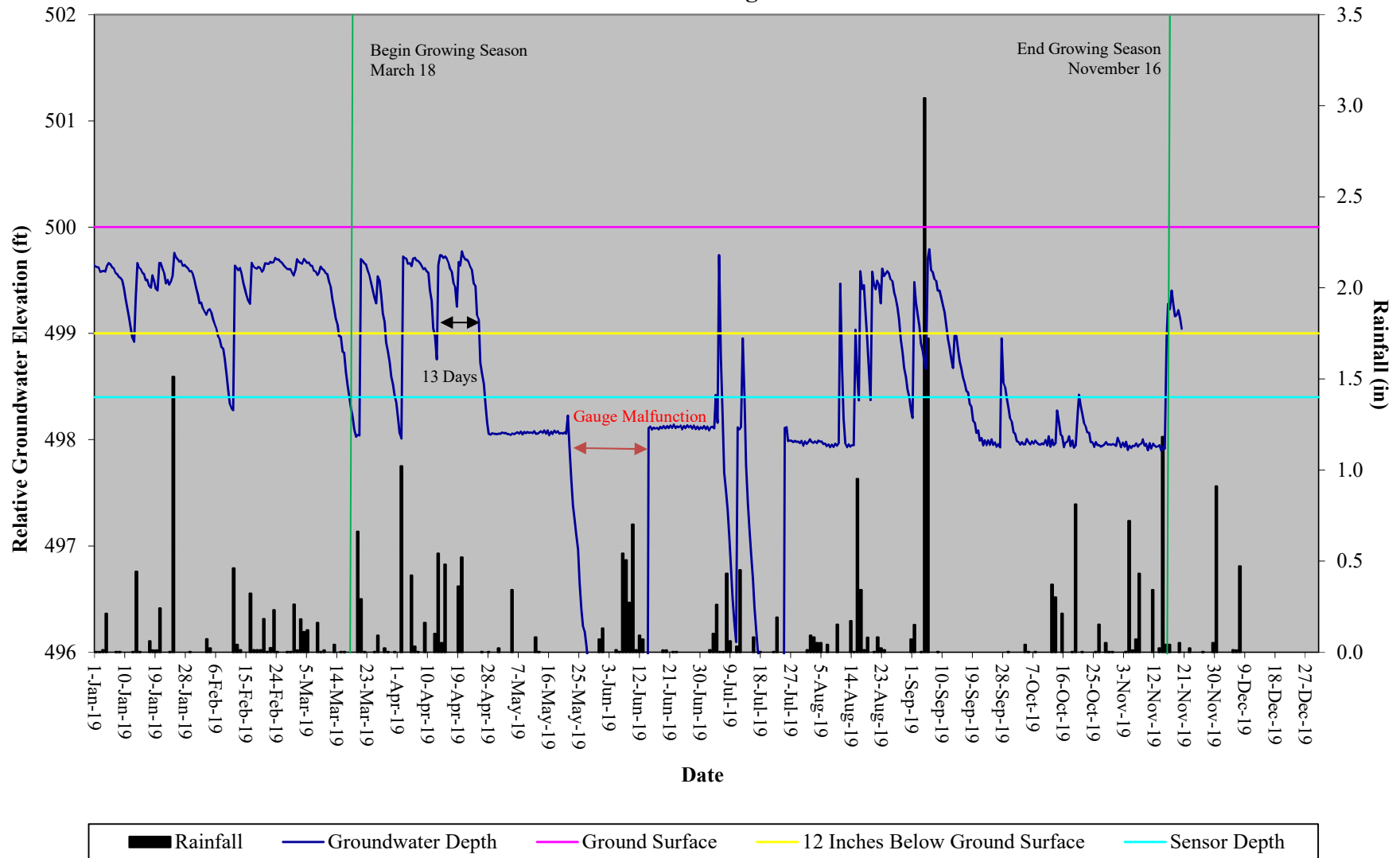
Bear Basin Restoration Site Hydrograph Wetland Gauge 13



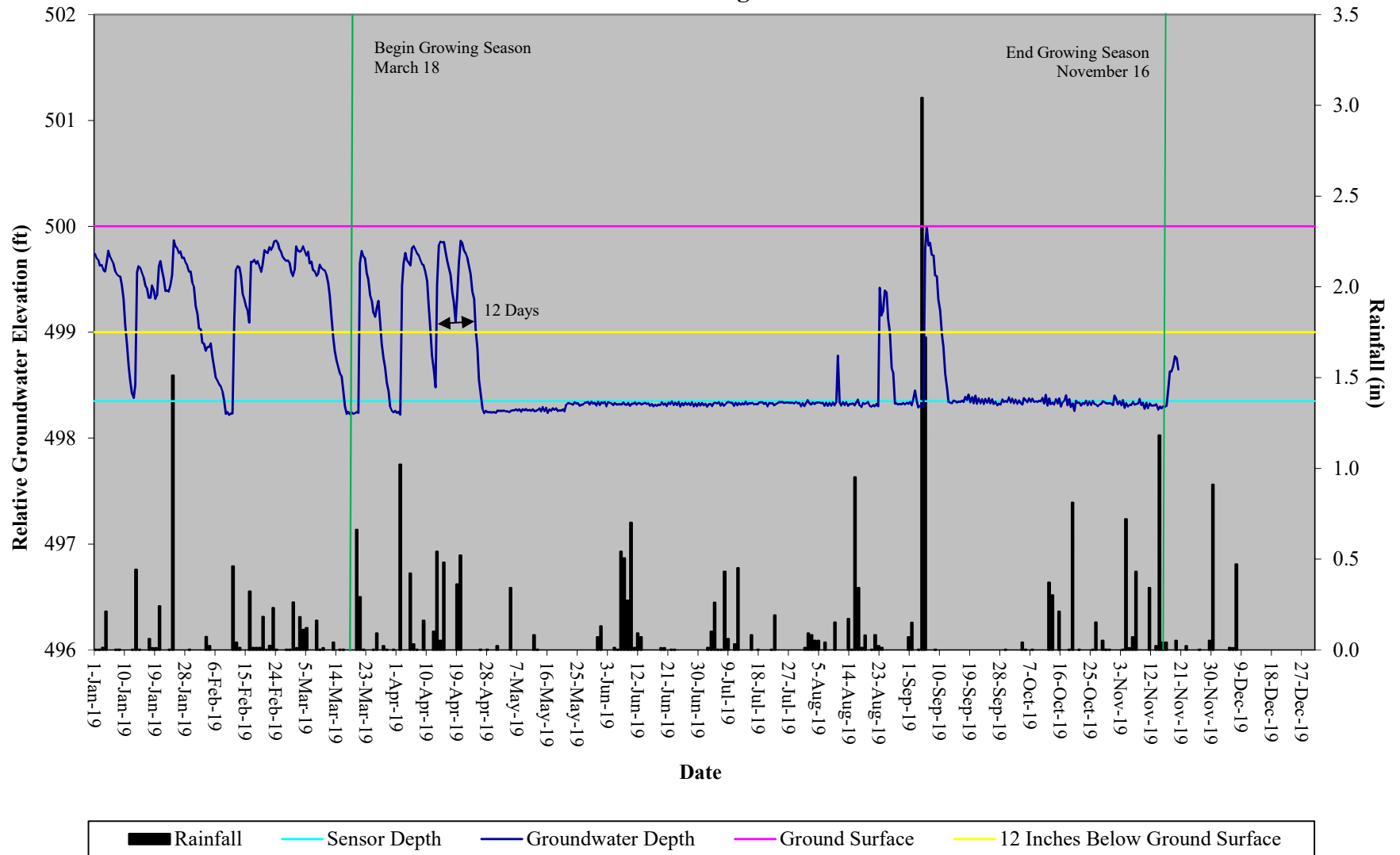
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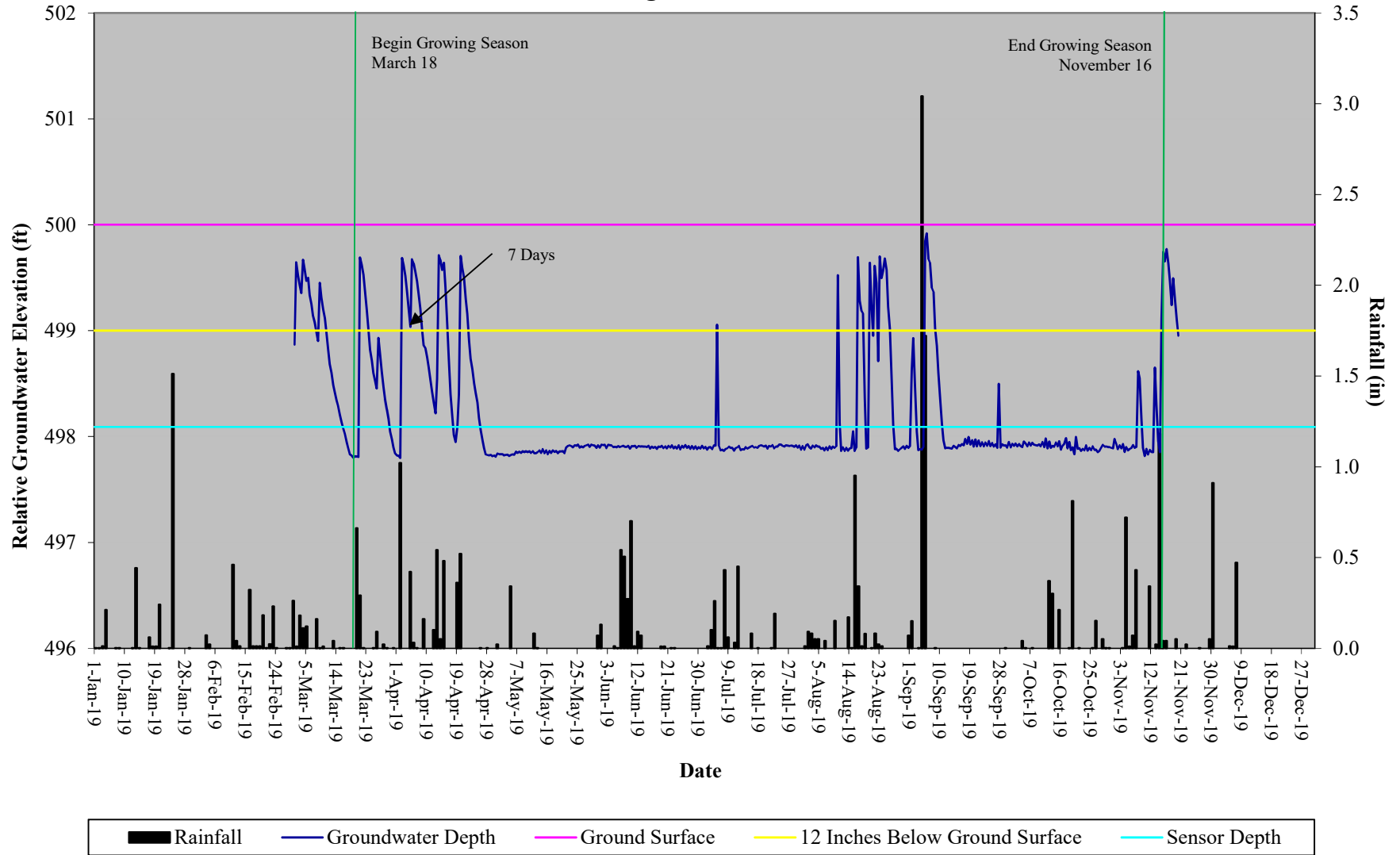
Bear Basin Restoration Site Hydrograph Wetland Gauge 15



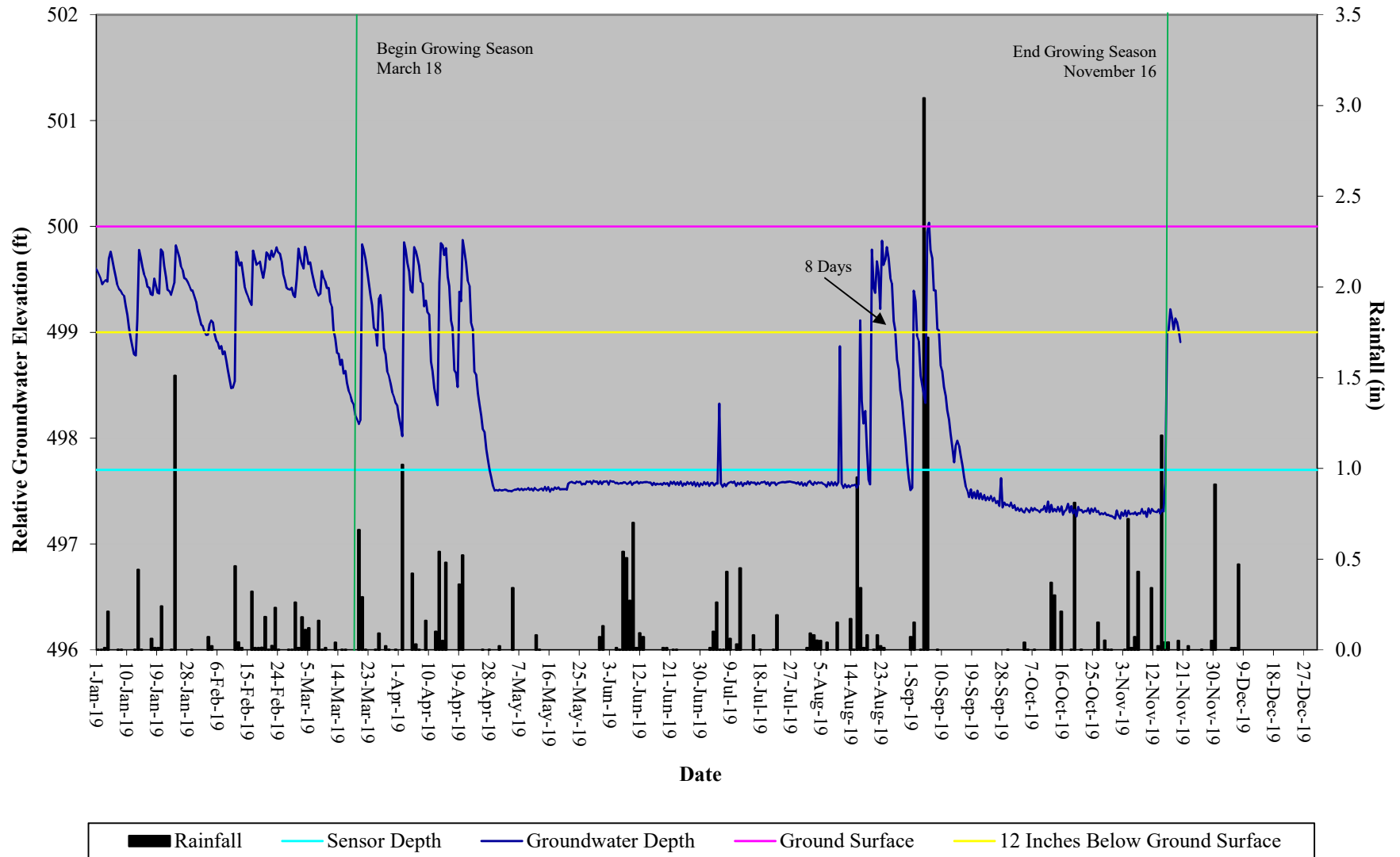
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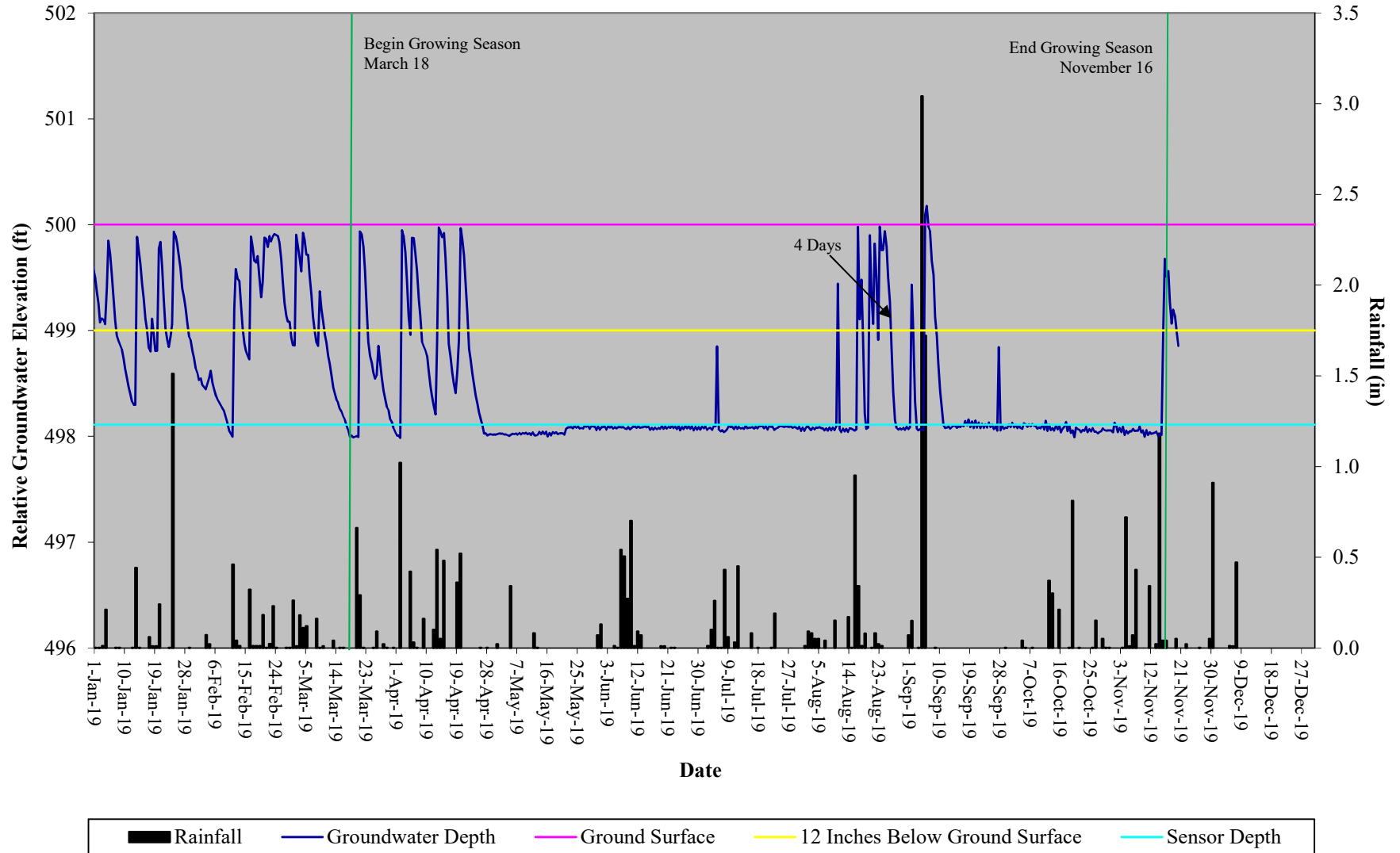
Bear Basin Restoration Site Hydrograph Wetland Gauge 17 - non-credit zone



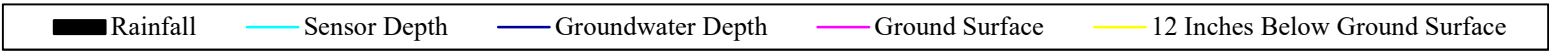
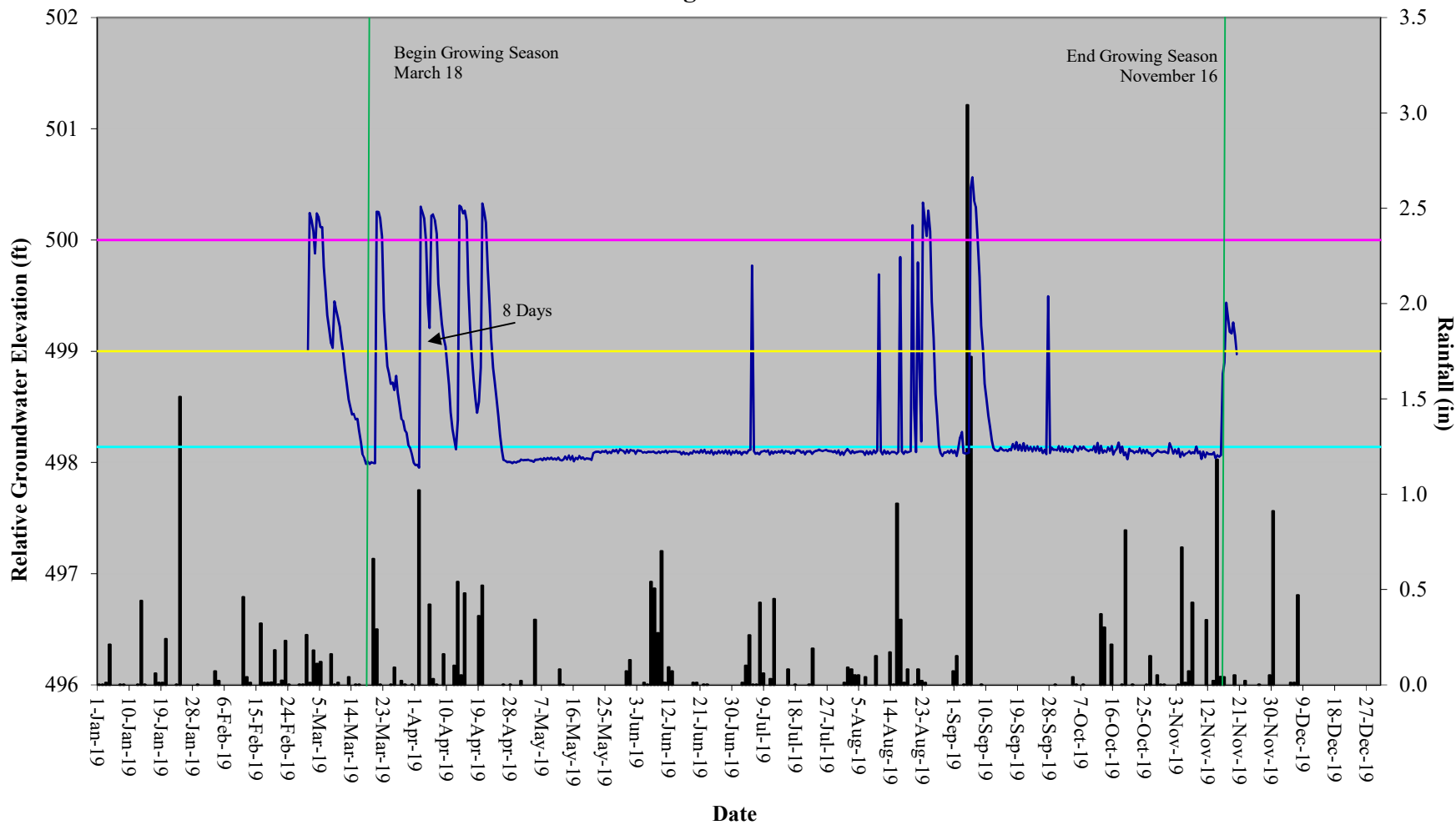
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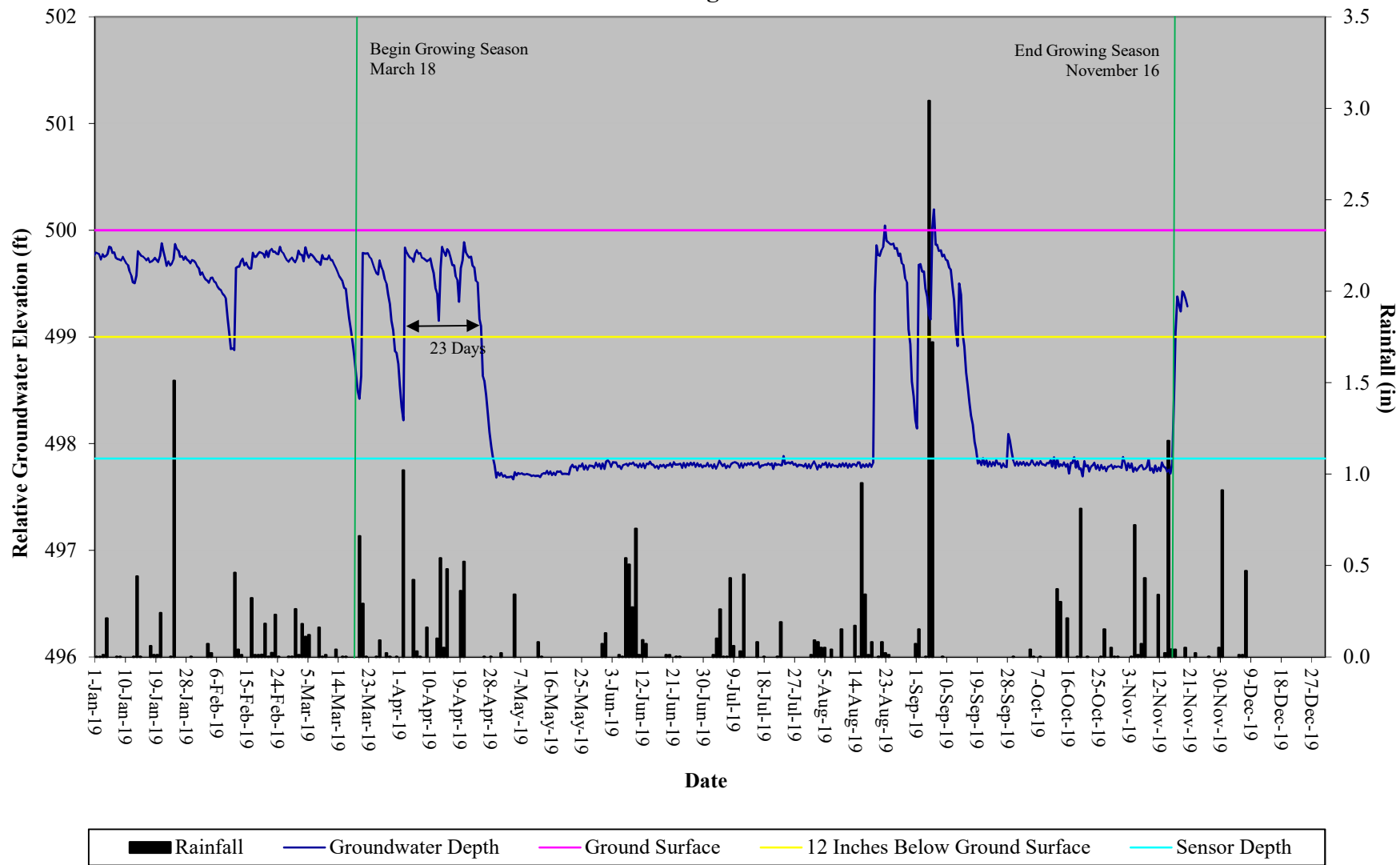
Bear Basin Restoration Site Hydrograph Wetland Gauge 19



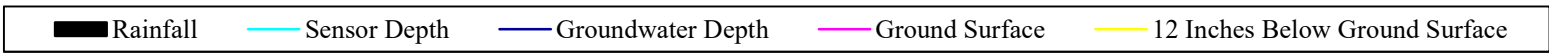
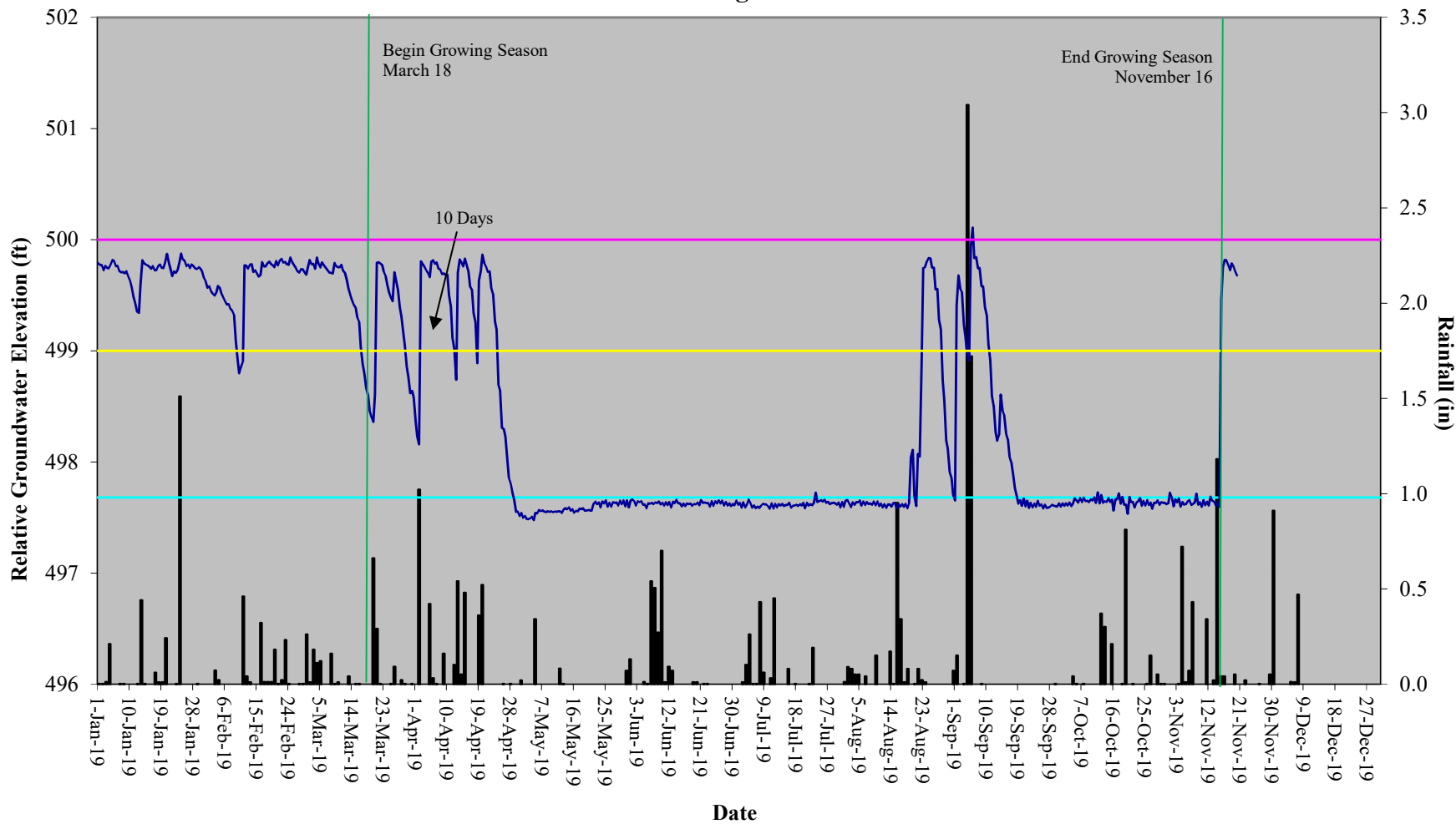
Bear Basin Restoration Site Hydrograph Wetland Gauge 20 - non-credit zone



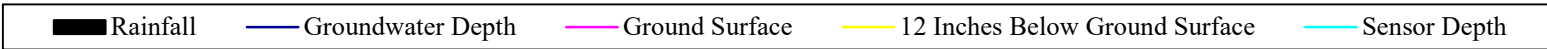
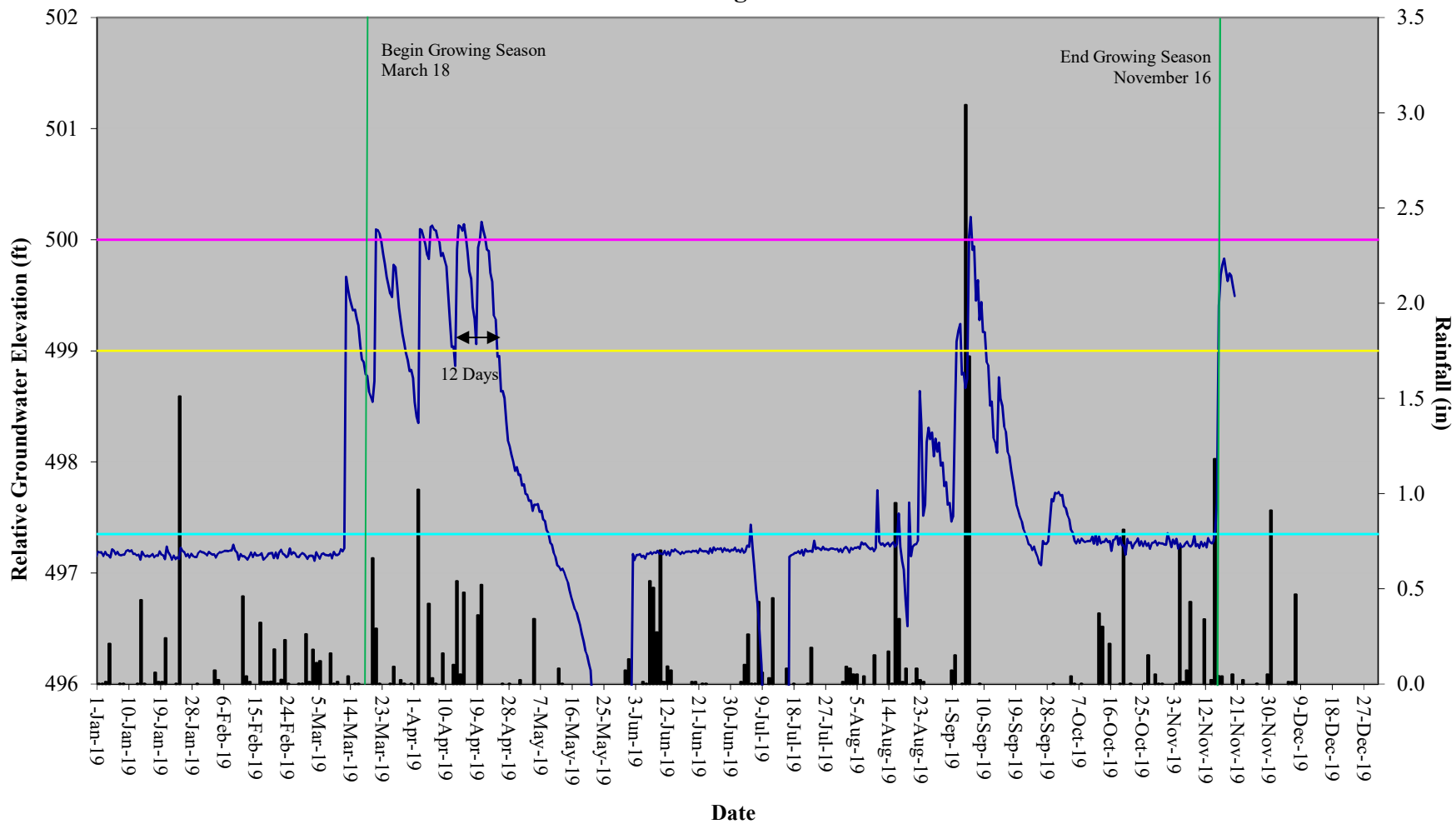
Bear Basin Restoration Site Hydrograph Wetland Gauge 21



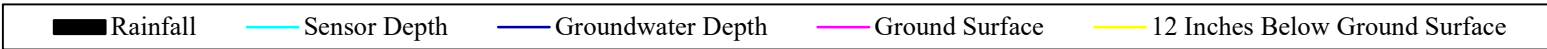
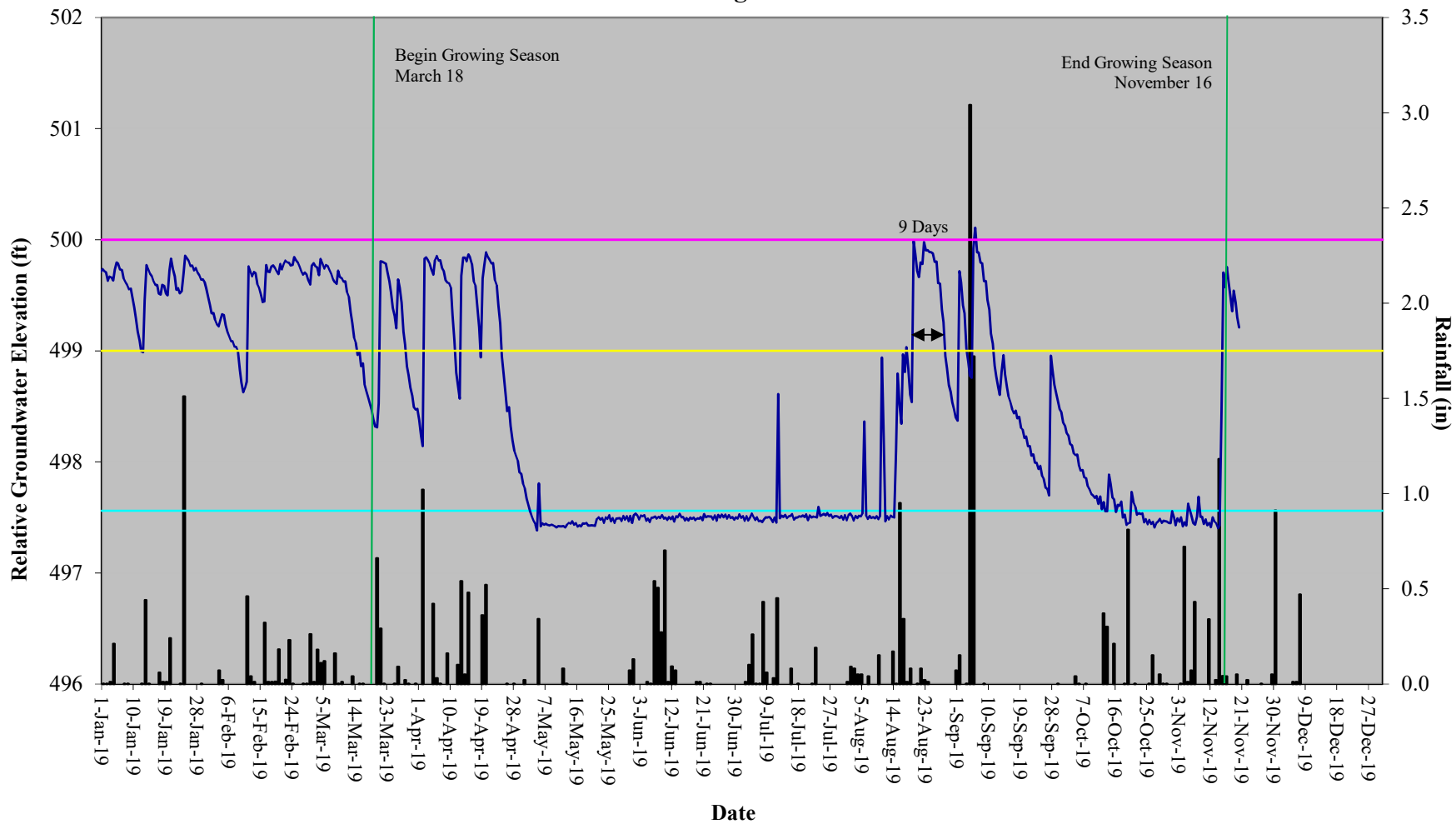
Bear Basin Restoration Site Hydrograph Wetland Gauge 22



Bear Basin Restoration Site Hydrograph Wetland Gauge 23



Bear Basin Restoration Site Hydrograph Wetland Gauge 24



Bear Basin Restoration Site Hydrograph Wetland Gauge 25

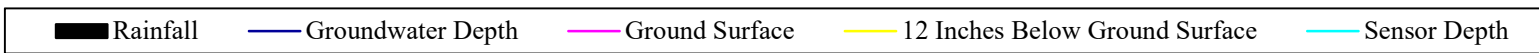
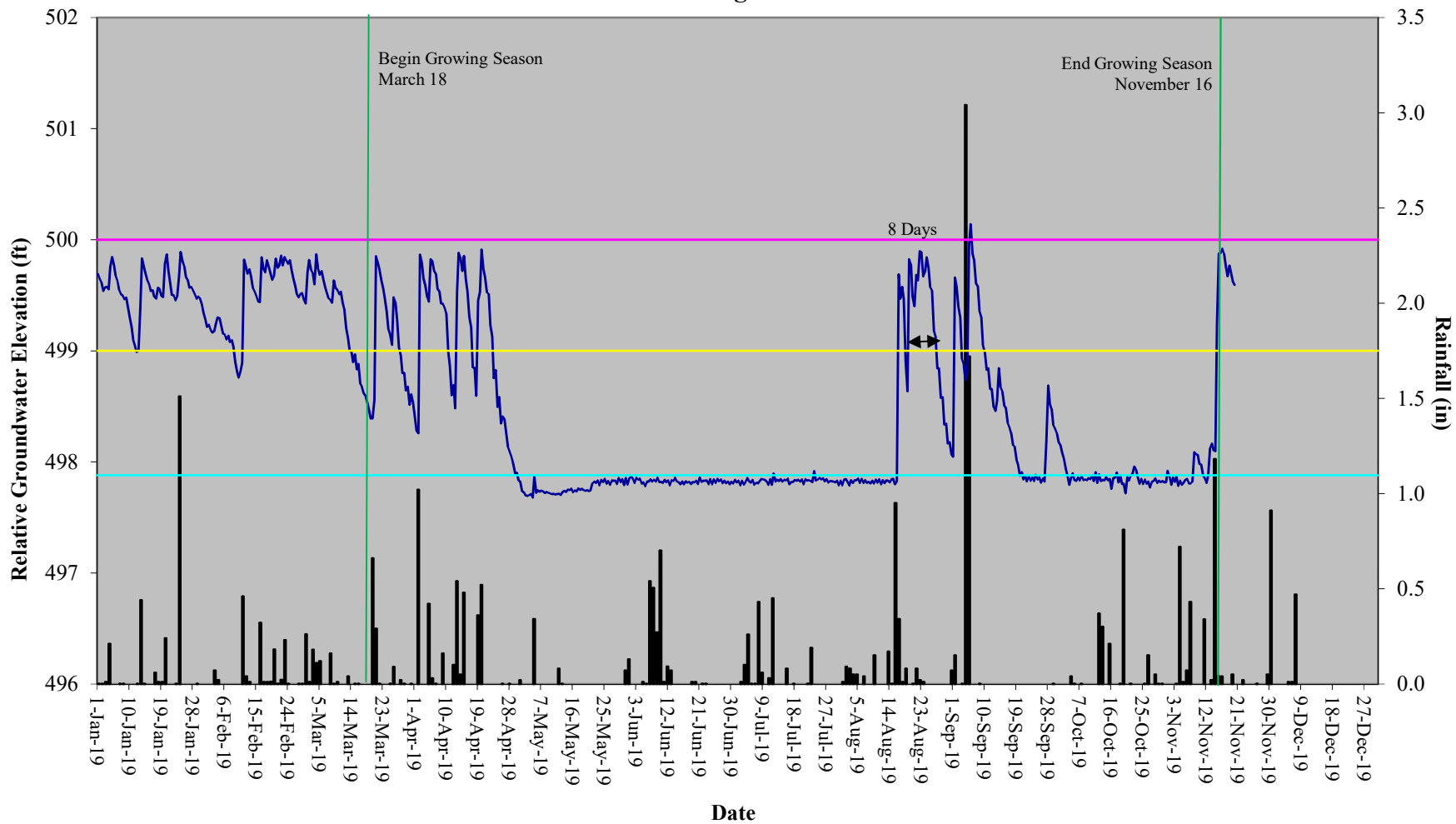


Table 9. Wetland Hydrology Criteria Attainment Table							
Project Number and Name: 95362 - Bear Basin Restoration Site							
Success Criteria (20 Days) (8%)	Success Criteria Achieved / Max Consecutive Days During Growing Season (Percentage)						
	MY-01 2015	MY-02 2016	MY-03 2017	MY-04 2018	MY-05 2019	MY-06	MY-07
Gauge 1	Yes/23 (9.4%)	Yes/24 (9.8%)	Yes/26 (10.7%)	Yes/31 (12.7%)	No/12 (4.9%)		
Gauge 2	Yes/28 (11.5%)	Yes/42 (17.2%)	Yes/28 (11.5%)	Yes/37 (15.2%)	Yes/40 (16.4%)		
Gauge 3	Yes/22 (9.0%)	No/14 (5.7%)	No/10 (4.1%)	Yes/27 (11.1%)	Yes/24 (9.8%)		
Gauge 4	No/17 (7.0%)	No/15 (6.1%)	Yes/25 (10.2%)	Yes/26 (10.7%)	No/9 (3.7%)		
Gauge 5	Yes/90 (36.9%)	Yes/48 (19.7%)	Yes/30 (12.3%)	Yes/48 (19.7%)	Yes/43 (17.6%)		
Gauge 6	Yes/28 (11.5%)	Yes/41 (16.8%)	Yes/29 (11.9%)	Yes/46 (18.9%)	Yes/39 (16.0%)		
Gauge 7	Yes/51 (20.9%)	Yes/45 (18.4%)	Yes/25 (10.2%)	Yes/47 (19.3%)	Yes/56 (23.0%)		
Gauge 8	Yes/28 (11.5%)	Yes/42 (17.2%)	Yes/27 (11.1%)	Yes/33 (13.5%)	Yes/41 (16.8%)		
Gauge 9	Yes/23 (9.4%)	Yes/23 (9.4%)	Yes/25 (10.2%)	Yes/31 (12.7%)	No/13 (5.3%)		
Gauge 10	Yes/24 (9.8%)	No/18 (7.4%)	Yes/26 (10.7%)	Yes/33 (13.5%)	Yes/23 (9.4%)		
Gauge 11*	15 (6.1%)	15 (6.1%)	4 (1.6%)	13 (5.3%)	4 (1.6%)		
Gauge 12*	25 (10.2%)	19 (7.8%)	25 (10.2%)	32 (13.1%)	23 (9.4%)		
Gauge 13	Yes/27 (11.1%)	Yes/42 (17.2%)	Yes/26 (10.7%)	Yes/32 (13.1%)	No/11 (4.5%)		
Gauge 14	Yes/25 (10.2%)	No/19 (7.8%)	Yes/26 (10.7%)	Yes/32 (13.1%)	Yes/23 (9.4%)		
Gauge 15	Yes/35 (14.3%)	Yes/42 (17.2%)	Yes/27 (11.1%)	Yes/33 (13.5%)	No/13 (5.3%)		
Gauge 16	Yes/22 (9.0%)	No/14 (5.7%)	No/10 (4.1%)	Yes/31 (12.7%)	No/12 (4.9%)		
Gauge 17*	23 (9.4%)	14 (5.7%)	9 (3.7%)	14 (5.7%)	7 (2.9%)		
Gauge 18	Yes/22 (9.0%)	No/14 (5.7%)	No/9 (3.7%)	Yes/26 (10.7%)	No/8 (3.3%)		
Gauge 19	No/18 (7.4%)	No/12 (4.9%)	No/7 (2.9%)	Yes/25 (10.2%)	No/4 (1.6%)		
Gauge 20*	19 (7.8%)	12 (4.9%)	7 (2.9%)	26 (10.7%)	8 (3.3%)		
Gauge 21**				Yes/30 (12.3%)	Yes/23 (9.4%)		
Gauge 22**				Yes/27 (11.1%)	No/10 (4.1%)		
Gauge 23**				Yes/26 (10.7%)	No/12 (4.9%)		
Gauge 24**				Yes/27 (11.1%)	No/9 (3.7%)		
Gauge 25**				Yes/26 (10.7%)	No/8 (3.3%)		

*=non-credit bearing area **=Gauge installed March 7, 2018