Bowl Basin Restoration Site
Monitoring Report MY06
DMS Project # 95721
DMS Contract # 005012

Onslow County, NC
CU# 03020106
DWR# 2013-0864
SAW# 2013-00393

Submitted to:

NCDMS, 1652 Mail Service Center, Raleigh, NC 27699-1652

Construction Completed: February 2015
Data Collection: 2020
Submitted: December 2020

Mitigation Project Name	**Bowl Basin Non-Riparian Wetland Mitigation**	**USACE Action ID**	**2013-00393**
DMS ID	**95721**	**DWR Permit**	**2013-0864**
River Basin	**White Oak**	**Date Project Instituted**	**11/30/2012**
Cataloging Unit	**03020106**	**Date Prepared**	**4/21/2020**
County	**Onslow**	**Stream/Wet. Service Area**	**White Oak 03020106**

Todd J Tugwell 9/21/2020

Signature & Date of Official Approving Credit Release

1 - For NCDMS, no credits are released during the first milestone

2 - For NCDMS projects, the initial credit release milestone occurs automatically when the as-built report (baseline monitoring report) has been made available to the IRT by posting it to the DMS portal, provided the following have been met:

1) Approved of Final Mitigation Plan

2) Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property.

3) Completion of all physical and biological improvements to the mitigation site pursuant to the mitigation plan.

4) Receipt of necessary DA permit authorization or written DA approval for projects where DA permit issuance is not required.

3 - A 10% reserve of credits is to be held back until the bankfull event performance standard has been met.

Credit Release Milestone	**Non-Riparian Credits**						
Project Credits	**Scheduled Releases %**	**Proposed Releases %**	**Proposed Released #**	**Not Approved # Releases**	**Approved Credits**	**Anticipated Release Year**	**Actual Release Date**
1 - Site Establishment	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2 - Year 0 / As-Built	30.00%	30.00%	3.510	0.000	3.510	2015	9/29/2015
3 - Year 1 Monitoring	10.00%	10.00%	1.170	0.000	1.170	2016	4/25/2016
4 - Year 2 Monitoring	10.00%	10.00%	1.170	0.000	1.170	2017	4/3/2017
5 - Year 3 Monitoring	15.00%	15.00%	1.755	0.000	1.755	2018	4/25/2018
6 - Year 4 Monitoring	5.00%	5.00%	0.585	0.000	0.585	2019	4/26/2019
7 - Year 5 Monitoring	15.00%	15.00%	1.755	0.000	1.755	2020	4/21/2020
8 - Year 6 Monitoring	5.00%					2021	
9 - Year 7 Monitoring	10.00%					2022	
Stream Bankfull Standard	.00%	N/A	N/A	N/A	N/A	N/A	N/A
			Totals	0.000	9.945		

Total Gross Credits	11.700
Total Unrealized Credits to Date	0.000
Total Released Credits to Date	9.945
Total Percentage Released	85.00%
Remaining Unreleased Credits	1.755

Notes

1/6/2019: During the review of the Year 4 monitoring report, DMS discovered that the credit release schedule was incorrect from what was published in the final mitigation plan. The credit release schedule was adjusted for the unreleased credits after 8/8/2019.

Contingencies (if any)

Project Quantities

Mitigation Type	**Restoration Type**	**Physical Quantity**
Non-Riparian	Restoration	11.700

Debits							**Non-Riparian Restoration Credits**
Beginning Balance (mitigation credits)							**11.700**
Released Credits							**9.945**
Unrealized Credits							**0.000**
Owning Program	**Req. Id**	**TIP #**	**Project Name**	**USACE Permit #**	**DWR Permit #**	**DCM Permit #**	
Total Credits Debited							**0.000**
Remaining Available balance (Released credits)							**9.945**
Remaining balance (Unreleased credits)							**1.755**

Monitoring and Design Firm

4505 Falls of Neuse Road
Suite 400
Raleigh, NC 27609
Phone: (919) 278-2514
Fax: (919) 783-9266

Project Manager: Tim Morris
Email: tim.morris@kci.com
KCI Project No: 20122265

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: February 2, 2021
To: Lindsay Crocker, DMS Project Manager
From: Tim Morris, Project Manager
KCI Associates of North Carolina, PA
Subject: MY-06 Monitoring Report Comments
Bowl Basin DMS#95721, Contract 005012
White Oak River Basin CU 03030001
Onslow County, North Carolina

Please find below our responses in italics to the MY-06 Monitoring Report comments from NCDMS received on January 19, 2021, for the Bowl Basin Wetland Restoration Site.

1. The report describes the rainfall as "average" in the text, but the data shows it is erratic (dry, normal, above average). DMS suggests revising wording, especially the dry antecedent conditions.
KCI Response: A discussion contextualizing the rainfall this year has been added to the report.

2. Two of the gauges that are not meeting presents somewhat concerning data for MY6. It is important that KCI retrieve any data from these three non-meeting gauges by working with the manufacturer if possible. If there are any possible explanations or theories, please add them to the report.
KCI Response: Gauge 3 has been over 5% in every monitoring year but has only achieved the success criteria in 2 of the 6 monitoring years. All of the other gauges have achieved the success criteria for at least 4 of the 6 monitoring years. Additionally, all of the gauges that failed to meet the success criteria failed to meet it in 2019, which was a historically dry year for the site. Because of this, KCI does not believe that any of the gauges besides Gauge 3 represent a risk to the site's success. We are working with the gauge manufacturer to obtain the data off of the three malfunctioning gauges and will add this data to the report once it is available.

3. KCI may want to evaluate hydrology of the gauges with a more modern growing season estimate for discussion purposes.
KCI Response: KCI evaluated the hydrology for all monitoring years using a growing season developed with data from the 30 years prior to site construction (1985-2014). This data indicated a growing season of March 8 to December 1 and a success criteria of 24 days. Using these growing season dates, Gauge 3 would have achieved the success criteria in MY01 and Gauges 1 and 4 would have achieved the success criteria this year.

4. Please submit the photo point features included in the CCPV (shapefile).
Please include the sweetgum treatment feature that is displayed in the CCPV (shapefile).
Please submit a shapefile containing all the groundwater gauges.
KCI Response: These shapefiles have been included in the digital deliverables.

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

Sincerely,

Tim Morris
Project Manager

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY / PROJECT ABSTRACT

The Bowl 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 03020106 Watershed Cataloging Unit (8-digit HUC) and the Local Watershed Unit (14-digit HUC) 03020106010010. In DMS' most recent publication of excluded and Targeted Local Watersheds/Hydrologic Units, the 03020106010010 14-digit HUC has been identified as a Targeted Local Watershed.

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 project site, which is protected by an 11.7-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 White Oak River Road approximately 13.5 miles north of Jacksonville, North Carolina.

The BBRS provided mitigation for wetland impacts within Hydrologic Unit 03020106 by restoring 11.7 acres of wetland, generating 11.7 non-riparian wetland mitigation units (WMU's).

The BBRS 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.

2.0 MONITORING RESULTS

2.1 VEGETATION MONITORING

The success criteria for the planted species in the mitigation area will be based on the vegetative density estimated as woody stems/acre based on monitoring plot data. 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, ten 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.

No vegetation monitoring occurred during MY06, as stipulated in the Mitigation Plan. In general the site is well vegetated, with widespread herbaceous coverage and many tall, healthy, planted stems. There are parts of the site that contain dense areas of sweetgum. These areas were treated in the spring of 2017, spring of 2019 and again during the fall of 2020. This treatment consisted of cutting the sweetgum and then spraying the stumps with an herbicide. This treatment will be repeated as necessary to ensure the sweetgum does not out-compete the planted stems.

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 9% 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 “Accessing 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 9% (22 days) of the 244-day growing season. Wetland hydrology will be monitored with eight automatic gauges that record water table depth.

The wetland gauges will be checked and/or downloaded every other month. Daily data will be collected from the automatic gauges over the 7-year monitoring period. On May 7, 2020, two additional gauges were installed on the western side of the site to monitor areas that were not adequately covered by the eight gauges already installed on site.

The daily rainfall data was obtained from a local weather station in Jacksonville, NC; provided by the NC State Climate Office. For the 2020 year, the months of March, April, August, September, and October experienced average rainfall, while January, and July experienced below average rainfall. February, May, June, and November experienced above average rainfall in 2020. Although the overall rainfall total for the site was average for the year. After receiving a total of 6 inches of rain during the first 2 months of the growing season (3/18-5/16), the site then received 5.7 inches of rain in 5 days (5/17-5/21). This was followed by approximately three weeks with only 0.5 inches of rain (5/22-6/11) and then another 5.7 inches of rain in 5 days (6/12-6/16). This pattern continued throughout the growing season with long periods of relatively little rain followed by short periods of heavy rain. This inconsistent rain fall caused many of the gauges to have short dry periods during what would normally be jurisdictional hydrology.

During the site's sixth growing season, only 6 of the 10 gauges had continuous saturation within 12 inches of the ground surface for 9% (22 days) of the 243 day growing season (March 18 to November 16). Overall the gauges on site averaged 32 days (13.4%) of continuous saturation. Three of the four gauges that did not meet the success criteria malfunctioned early in the growing season. It is believed that, since most of the rain fell during the end of the growing season, that these gauges would have met the success criteria had they recorded for the whole year. KCI is currently working with the gauges' manufacturer to try and recover this data and will update the report if it becomes available.

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)

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

Appendix A

Project Vicinity Map and Background Tables

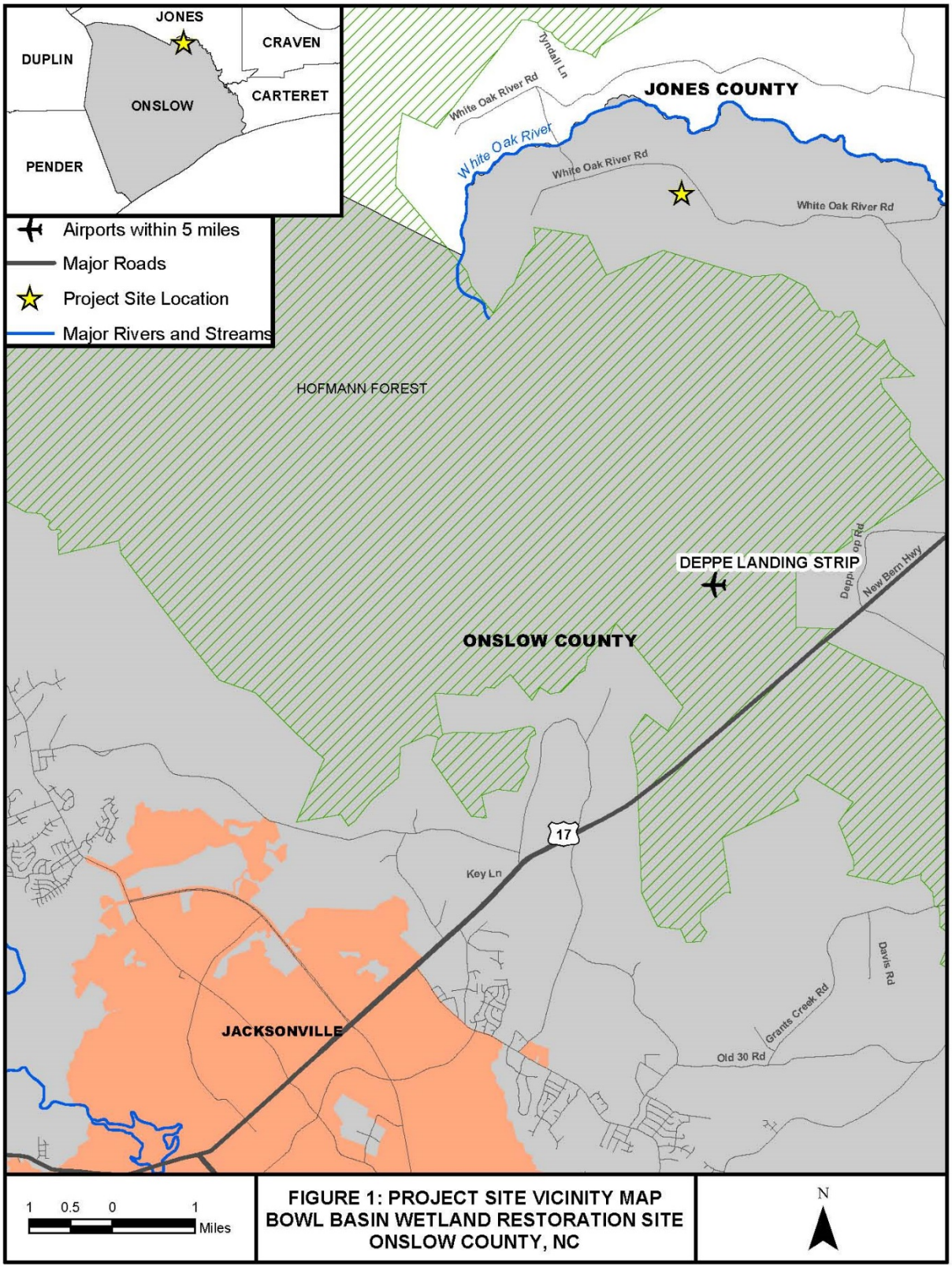

JONES
CRAVEN
DUPLIN
ONSLOW
CARTERET
PENDER
Airports within 5 miles
Major Roads
Project Site Location
Major Rivers and Streams
Tyndall Ln
White Oak River Rd
JONES COUNTY
White Oak River
White Oak River Rd
White Oak River Rd
HOFMANN FOREST
DEPPE LANDING STRIP
New Bern Hwy
ONSLOW COUNTY
17
Key Ln
Davis Rd
Grants Creek Rd
Old 30 Rd
JACKSONVILLE
1 0.5 0 1
Miles
FIGURE 1: PROJECT SITE VICINITY MAP
BOWL BASIN WETLAND RESTORATION SITE
ONSLOW COUNTY, NC
N

FIGURE 2: PROJECT SITE MITIGATION PLAN VIEW
BOWL BASIN WETLAND RESTORATION SITE
ONSLOW COUNTY, NC

Image Source: NC 2010 Statewide Orthoimagery.

Table 1. Project Components
Project Number and Name: 95721 – Bowl 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	-	-	-	-	11.7	-	-	-	-
Credits	-	-	-	-	11.7	-	-	-	-
TOTAL CREDITS	-		-		11.7		-	-	-

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	-	11.7 acres	-	Restoration	11.7 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				11.7 acres		
Enhancement						
Enhancement I						
Enhancement II						
Creation						
Preservation						
High Quality Preservation						
TOTAL	-	-	-	11.7 acres	-	-

Table 2. Project Activity & Reporting History Project Number and Name: 95721 - Bowl Basin Restoration Site		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Mitigation Plan		Oct 2014
Final Design - Construction Plans		Dec 2014
Construction		March 2015
Planting		March 2015
Baseline Monitoring/Report	April 2015	May 2015
Vegetation Monitoring	May 20, 2015	
Photo Points	May 26, 2015	
Year 1 Monitoring	Nov 2015	Jan 2016
Vegetation Monitoring	Oct 16, 2015	
Photo Points	Oct 16, 2015	
Gauge Downloads	Nov 25, 2015	
Year 2 Monitoring	Nov 2016	Dec 2016
Vegetation Monitoring	June 30, 2016	
Photo Points	Aug 23, 2016	
Gauge Downloads	Nov 22, 2016	
Sweetgum Treatment	May 2017	
Year 3 Monitoring	Dec 2017	Jan 2018
Vegetation Monitoring	June 26, 2017	
Photo Points	Nov 30, 2017	
Gauge Downloads	Dec 1, 2017	
Year 4 Monitoring	Nov 2018	Dec 2018
Vegetation Monitoring	N/A	
Photo Points	Nov 13, 2018	
Gauge Downloads	Nov 13, 2018	
Sweetgum Treatment	May 2019	
Year 5 Monitoring	Nov 2019	Dec 2019
Vegetation Monitoring	July 15, 2019	
Photo Points	Nov 20, 2019	
Gauge Downloads	Nov 20, 2019	
Sweetgum Treatment	Sept 2020	
Year 6 Monitoring	Nov 2020	Dec 2020
Vegetation Monitoring	N/A	
Photo Points	Dec 8, 2020	
Gauge Downloads	Dec 8, 2020	

Table 3. Project Contacts Project Number and Name: 95721 - Bowl Basin Restoration Site	
Design Firm	KCI Associates of North Carolina 4505 Falls of Neuse Road 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 Road 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	
	KCI Associates of North Carolina 4505 Falls of Neuse Road Suite 400 Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 278-2514 Fax: (919) 783-9266

Table 4. Project Attribute Table **Project Number and Name: 95721 – Bowl Basin Restoration Site**			
County	Onslow County		
Project Area (acres)	11.7 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	03020106	**USGS Hydrologic Unit 14-digit**	03020106010010
DWQ Sub-basin	03-05-01b		
Project Drainage Area (acres)	76.0 acres		
Project Drainage Area Percentage of Impervious Area	1%		
CGIA Land Use Classification	94% Cultivated, 4% Forest, and 2% Low-Intensity Development		
Wetland Summary Information			
Parameters	**Wetland Area**		
Size of Wetland (acres)	11.7 acres		
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)	Non-riparian		
Mapped Soil Series	Pantego loam by detailed soil investigation		
Drainage class	Poorly drained		
Soil Hydric Status	Drained Hydric		
Source of Hydrology	Groundwater / 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 - - - - - - 4019/765
- WETLAND GAUGE ACHIEVING HYDROLOGIC CRITERION
- WETLAND GAUGE BELOW HYDROLOGIC CRITERION
- PHOTO POINT (PP)
- FILLED DITCHES
- CONSERVATION EASEMENT =
  NONRIPARIAN WETLAND RESTORATION = 11.7 ACRES
- SWEETGUM TREATMENT (2017, 2019 & 2020)

**VEG MONITORING FROM MY05 (2019)*
IMAGE SOURCE: NC 2016 ORTHOIMAGERY

N
NC GRID NAD 83

−60′ −30′ 0′ 60′ 120′
GRAPHIC SCALE

CORNWALLIS ROAD

VEG PLOT #1 4816/769
PP1
GAUGE#1
VEG PLOT #2 3359/690
GAUGE#2
VEG PLOT #3 1619/728
VEG PLOT #10 1983/850
GAUGE#5
VEG PLOT #9 1983/526
GAUGE#8
PP6
PP2
GAUGE#9
VEG PLOT #8 3197/648
PP5
GAUGE#3
VEG PLOT #4 4087/850
VEG PLOT #7 4006/607
GAUGE#10
GAUGE#7
GAUGE#6
VEG PLOT #6 5908/890
PP4
VEG PLOT #5 9227/890
GAUGE#4
PP3

REVISIONS		
SYM.	DESCRIPTION	DATE

NCDEQ DIVISION OF MITIGATION SERVICES

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

BOWL BASIN
RESTORATION SITE
DMS PROJECT #95721
ONSLOW COUNTY, NORTH CAROLINA
MONITORING YEAR 06

DATE: DEC 2020
SCALE: GRAPHIC

CURRENT CONDITION PLAN VIEW

SHEET 1 OF 1
FIGURE 3

Table 5. Vegetation Condition Assessment

Project Number and Name: 95721 – Bowl Basin Restoration Site

Planted Acreage 11.7 **Easement Acreage 11.7**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	0	0.00	0.0%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
			Cumulative Total	0	0.00	0.0%
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. Area of Dense Sweetgum	Areas or points (if too small to render as polygons at map scale).	1000 SF	Pattern and Color	1	1.54	13.2%
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

PP1 – MY-00 – 5/20/15

PP1 – MY-05 – 12/8/20

PP2 – MY-00 – 5/20/15

PP2 – MY-05 – 12/8/20

PP3 – MY-00 – 5/20/15

PP3 – MY-06 – 12/8/20

PP4 – MY-00 – 5/20/15

PP4 – MY-06 – 12/8/20

PP5 – MY-00 – 5/20/15

PP5 – MY-06 – 12/8/20

PP6 – MY-00 – 5/20/15

PP6 – MY-06 – 12/8/20

Appendix C

Vegetation Plot Data

Table 6. CVS Stem Count Total and Planted by Plot and Speceies

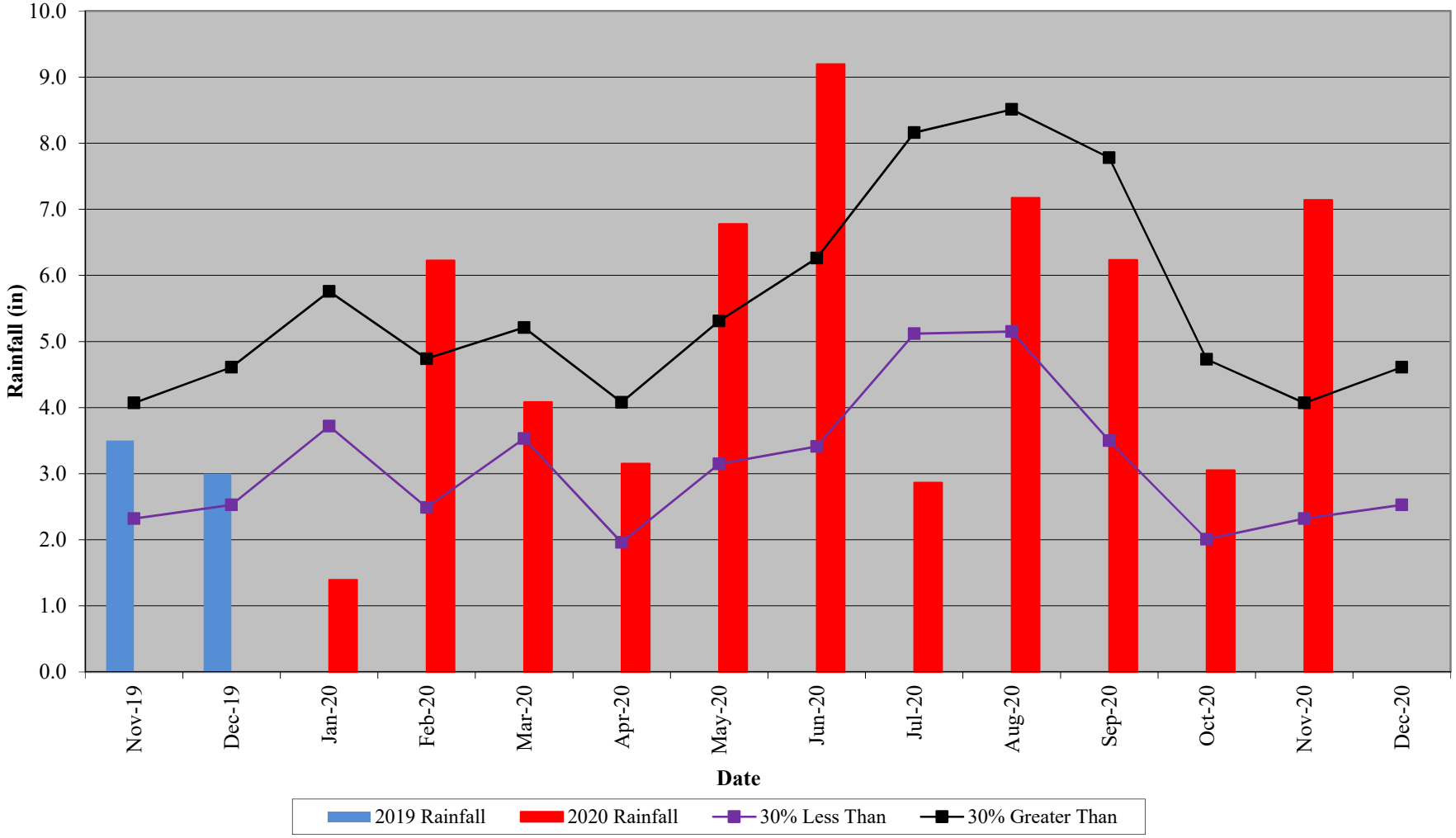
DMS Project Code 95721. Project Name: Bowl Basin

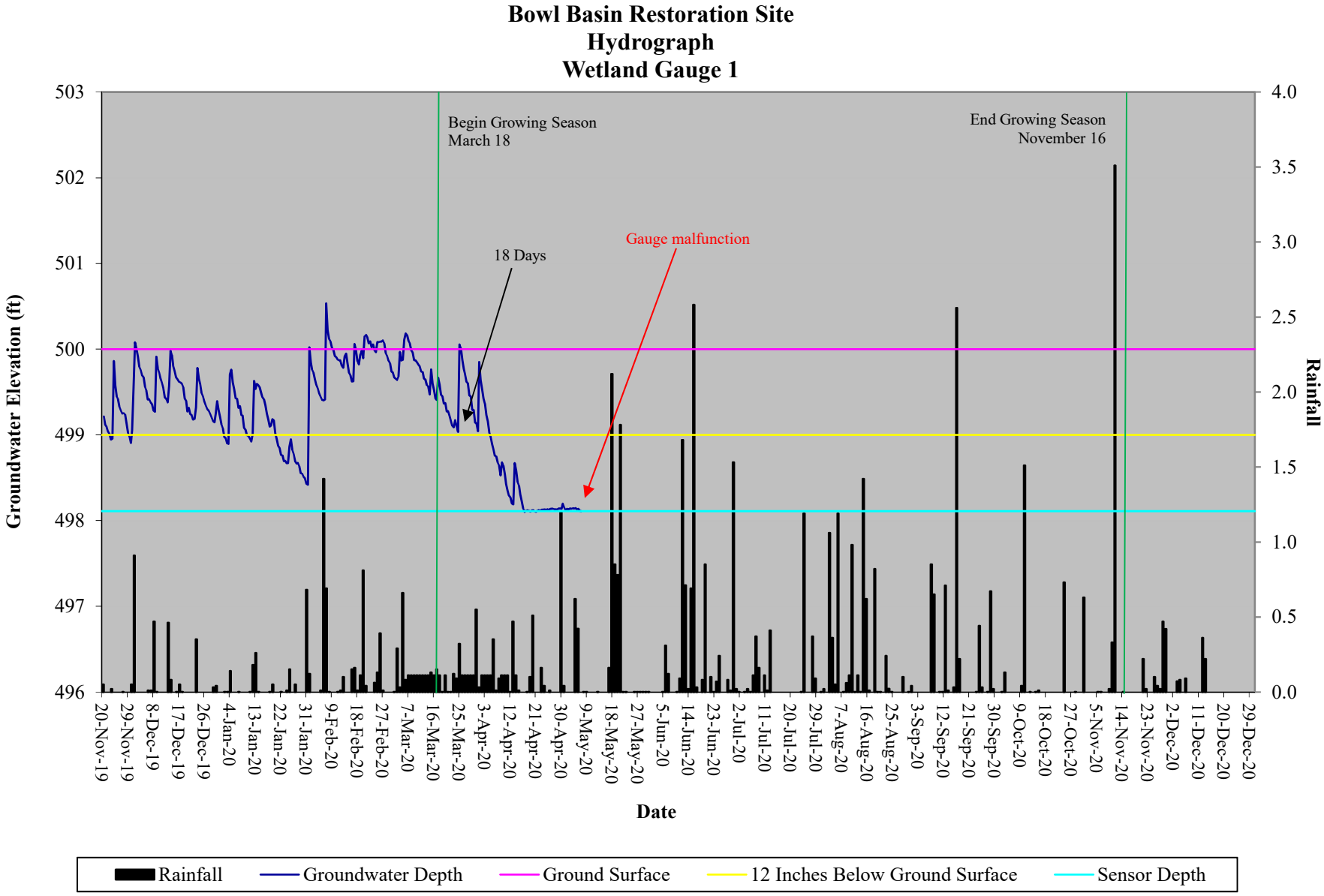
			Annual Means														
			MY5 (2019)			MY3 (2017)			MY2 (2016)			MY1 (2015)			MY0 (2015)		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer negundo	boxelder	Tree									1						
Acer rubrum	red maple	Tree			5			2			2			1			
Baccharis	baccharis	Shrub									7						
Baccharis halimifolia	eastern baccharis	Shrub			28			12									
Betula nigra	river birch	Tree	25	25	25	26	26	26	27	27	27	27	27	27	22	22	22
Celtis occidentalis	common hackberry	Tree									1						
Cephalanthus occidentalis	common buttonbush	Shrub	10	10	14	10	10	10	10	10	10	12	12	12	11	11	11
Diospyros virginiana	common persimmon	Tree			1			1			1						
Fraxinus pennsylvanica	green ash	Tree	56	56	57	55	55	56	57	57	57	55	55	59	51	51	51
Juglans nigra	black walnut	Tree			6			4			5			2			
Liquidambar styraciflua	sweetgum	Tree			578			437			417			280			
Magnolia virginiana	sweetbay	Tree	6	6	6	6	6	6	5	5	5	4	4	4	4	4	4
Morella cerifera	wax myrtle	shrub			4			3									
Myrica	sweetgale	shrub									2						
Nyssa aquatica	water tupelo	Tree	7	7	9	8	8	8	8	8	8	7	7	7	7	7	7
Nyssa biflora	swamp tupelo	Tree	5	5	5	5	5	5	5	5	5	5	5	5	3	3	3
Pinus taeda	loblolly pine	Tree			152			100			25						
Quercus michauxii	swamp chestnut oak	Tree	12	12	12	12	12	12	13	13	13	12	12	12	15	15	15
Quercus nigra	water oak	Tree			1												
Quercus pagoda	cherrybark oak	Tree	8	8	8	8	8	8	7	7	7	7	7	7	7	7	7
Quercus phellos	willow oak	Tree	11	11	11	12	12	12	11	11	11	9	9	11	9	9	9
Quercus shumardii	Shumard's oak	Tree							1	1	1	1	1	1	2	2	2
Salix	willow	Shrub or Tree									1						
Salix alba	white willow	Exotic									1						
Salix nigra	black willow	Tree			22			8			1	1	1	2			
Taxodium distichum	bald cypress	Tree	49	49	49	49	49	49	47	47	48	48	48	48	45	45	45
		Stem count	189	189	993	191	191	759	191	191	656	188	188	478	176	176	176
		size (ares)	10			10			10			10			10		
		size (ACRES)	0.25			0.25			0.25			0.25			0.25		
		Species count	10	10	19	10	10	18	11	11	23	12	12	15	11	11	11
		Stems per ACRE	765	765	4019	773	773	3072	773	773	2655	761	761	1934	712	712	712

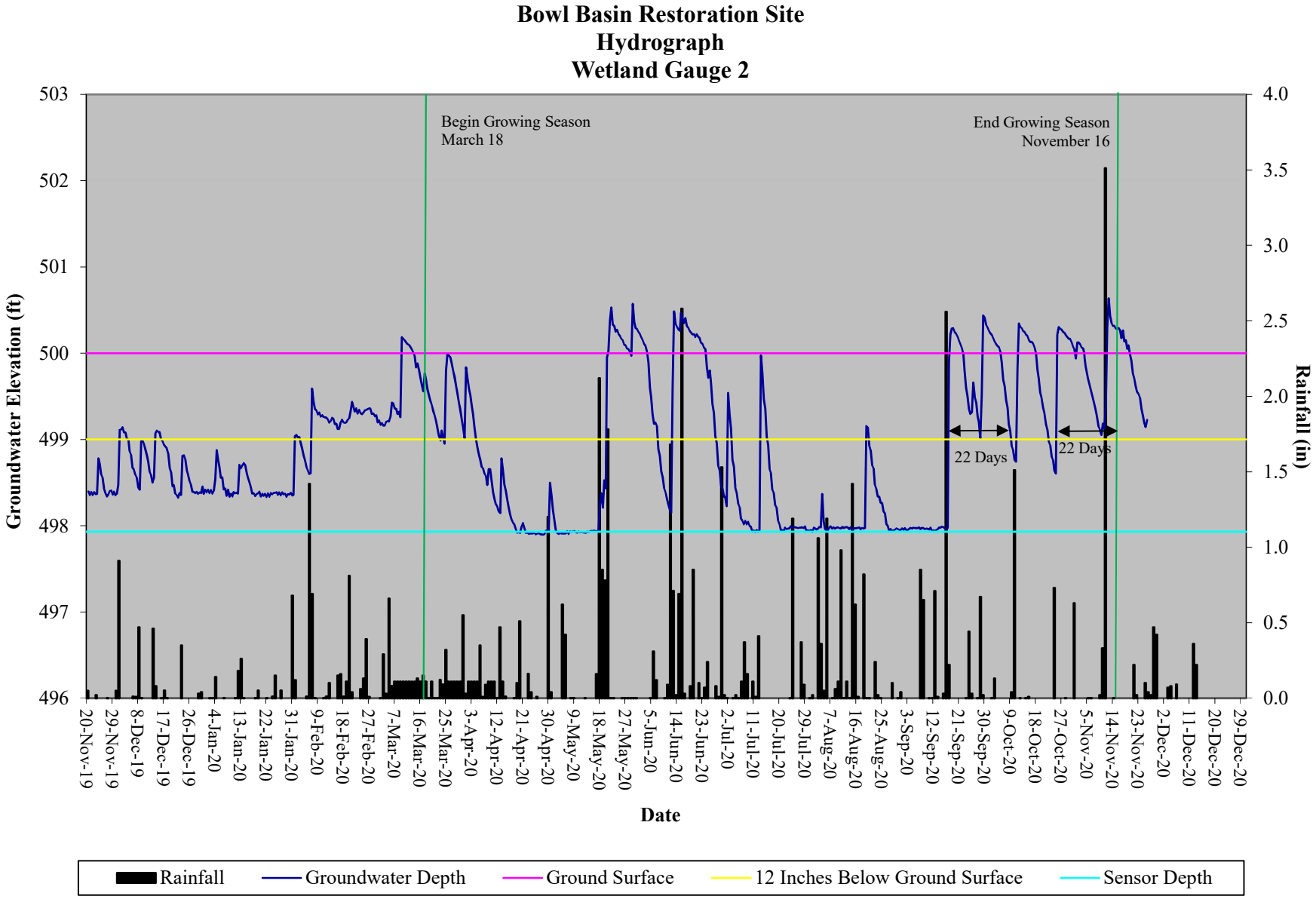
Appendix D

Hydrologic Data

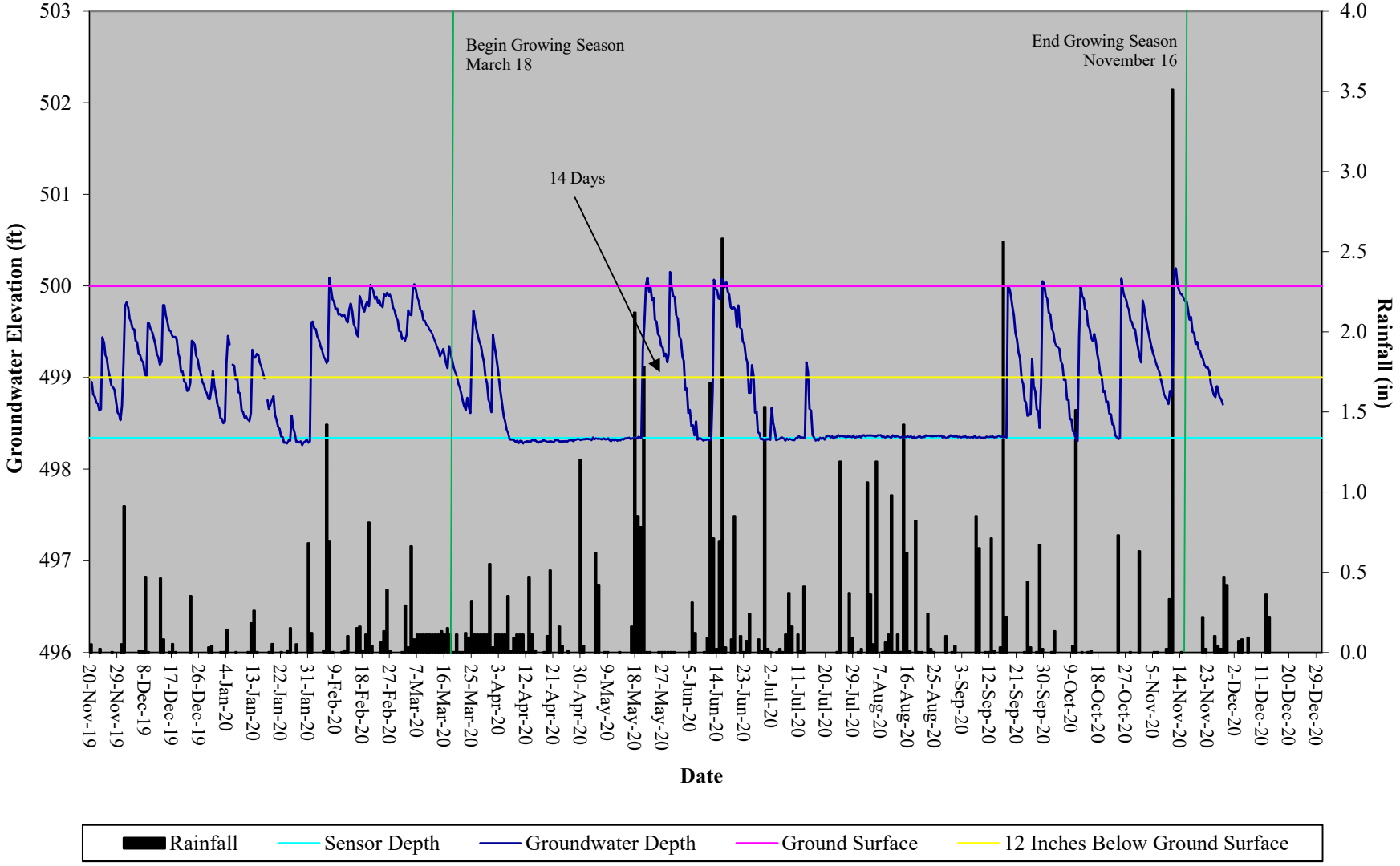
Bowl Basin Wetland Restoration Site
30-70 Percentile Graph
WETS Station Name: NHOF, Hoffman Forest

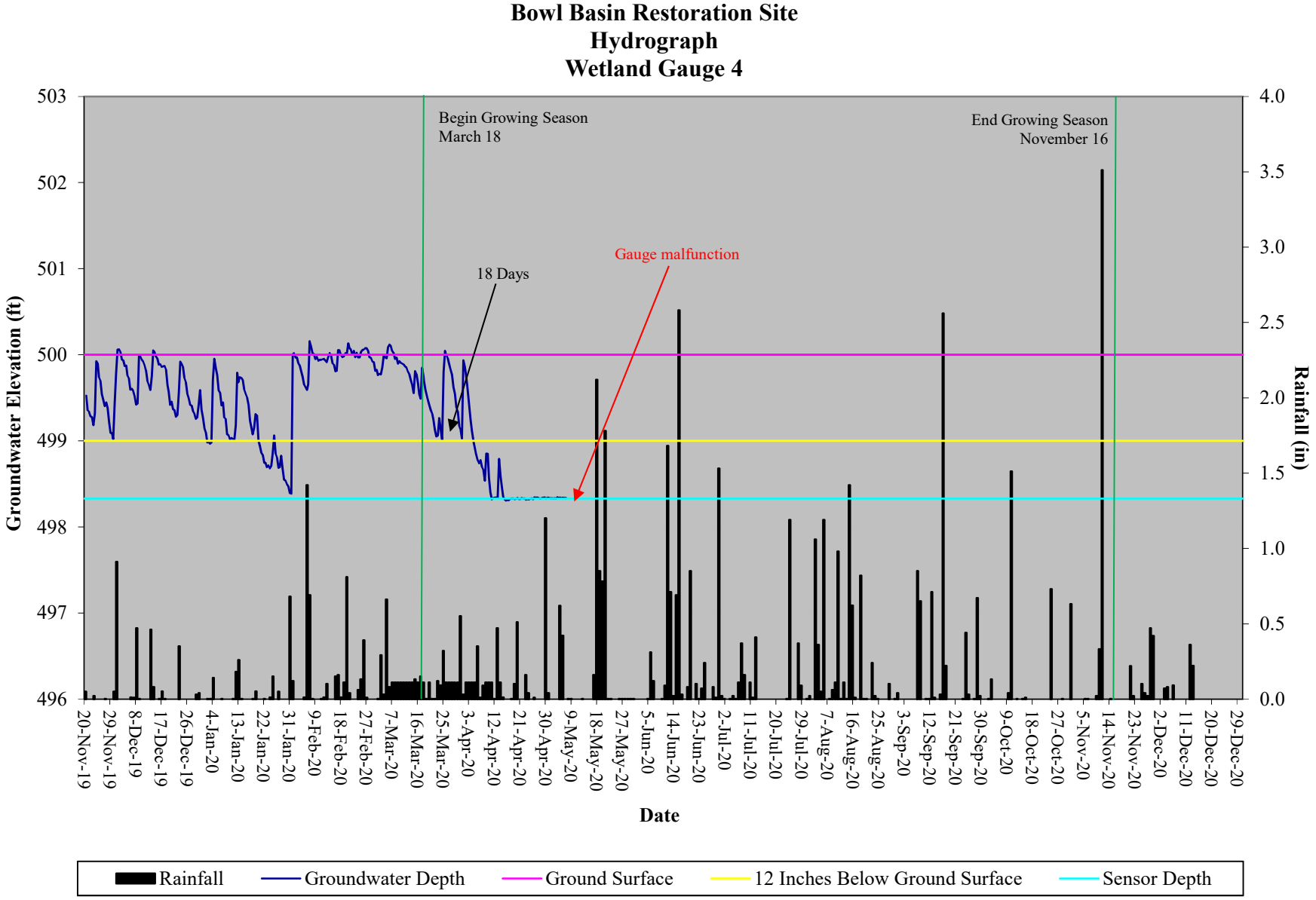


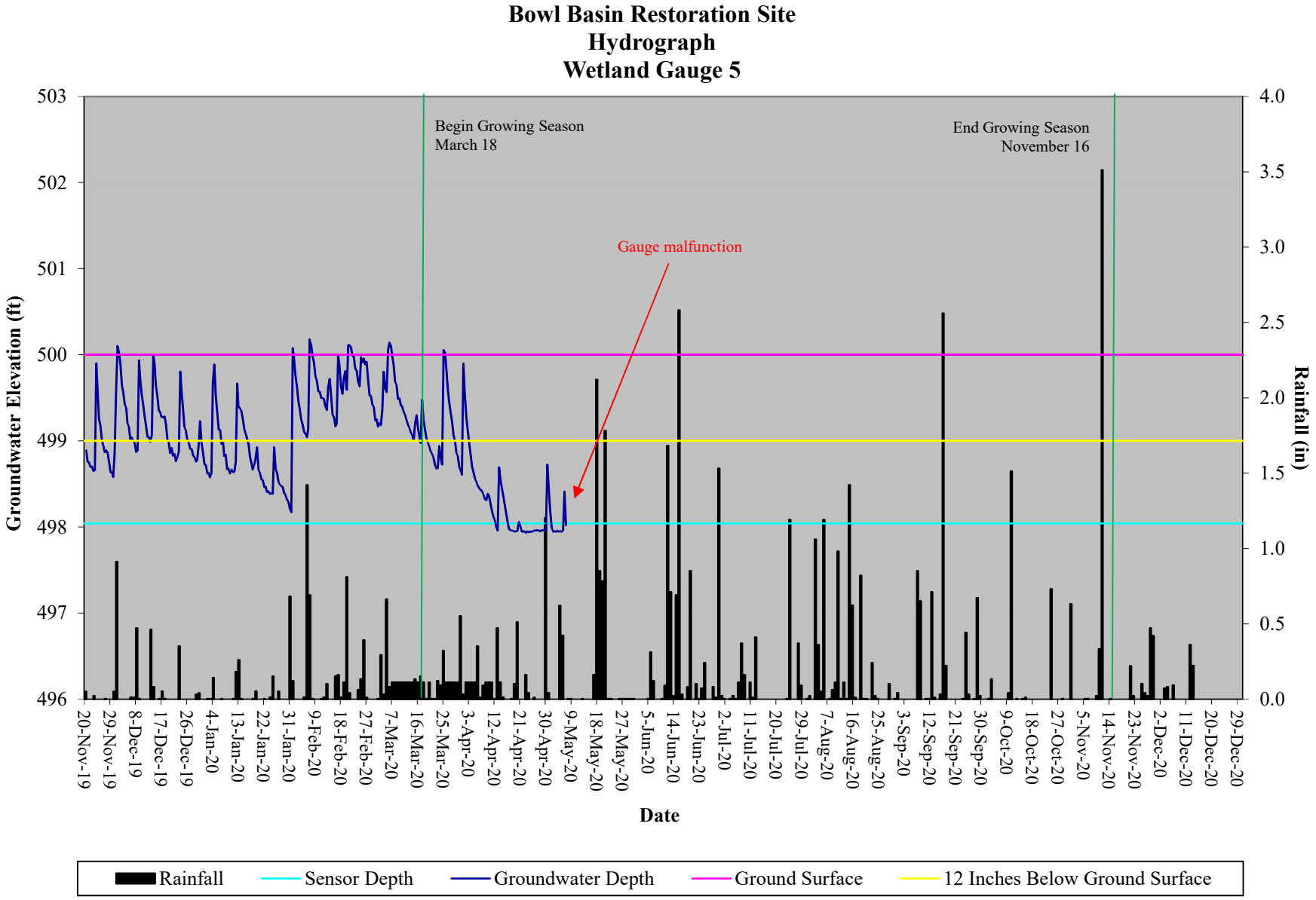

Bowl Basin Restoration Site
Hydrograph
Wetland Gauge 1
Groundwater Elevation (ft)
Rainfall
Date
Begin Growing Season
March 18
End Growing Season
November 16
18 Days
Gauge malfunction
503
502
501
500
499
498
497
496
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
20-Nov-19
29-Nov-19
8-Dec-19
17-Dec-19
26-Dec-19
4-Jan-20
13-Jan-20
22-Jan-20
31-Jan-20
9-Feb-20
18-Feb-20
27-Feb-20
7-Mar-20
16-Mar-20
25-Mar-20
3-Apr-20
12-Apr-20
21-Apr-20
30-Apr-20
9-May-20
18-May-20
27-May-20
5-Jun-20
14-Jun-20
23-Jun-20
2-Jul-20
11-Jul-20
20-Jul-20
29-Jul-20
7-Aug-20
16-Aug-20
25-Aug-20
3-Sep-20
12-Sep-20
21-Sep-20
30-Sep-20
9-Oct-20
18-Oct-20
27-Oct-20
5-Nov-20
14-Nov-20
23-Nov-20
2-Dec-20
11-Dec-20
20-Dec-20
29-Dec-20
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth


Bowl Basin Restoration Site
Hydrograph
Wetland Gauge 2
Groundwater Elevation (ft)
Rainfall (in)
Date
Begin Growing Season
March 18
End Growing Season
November 16
22 Days
22 Days
503
502
501
500
499
498
497
496
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
20-Nov-19
29-Nov-19
8-Dec-19
17-Dec-19
26-Dec-19
4-Jan-20
13-Jan-20
22-Jan-20
31-Jan-20
9-Feb-20
18-Feb-20
27-Feb-20
7-Mar-20
16-Mar-20
25-Mar-20
3-Apr-20
12-Apr-20
21-Apr-20
30-Apr-20
9-May-20
18-May-20
27-May-20
5-Jun-20
14-Jun-20
23-Jun-20
2-Jul-20
11-Jul-20
20-Jul-20
29-Jul-20
7-Aug-20
16-Aug-20
25-Aug-20
3-Sep-20
12-Sep-20
21-Sep-20
30-Sep-20
9-Oct-20
18-Oct-20
27-Oct-20
5-Nov-20
14-Nov-20
23-Nov-20
2-Dec-20
11-Dec-20
20-Dec-20
29-Dec-20
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth

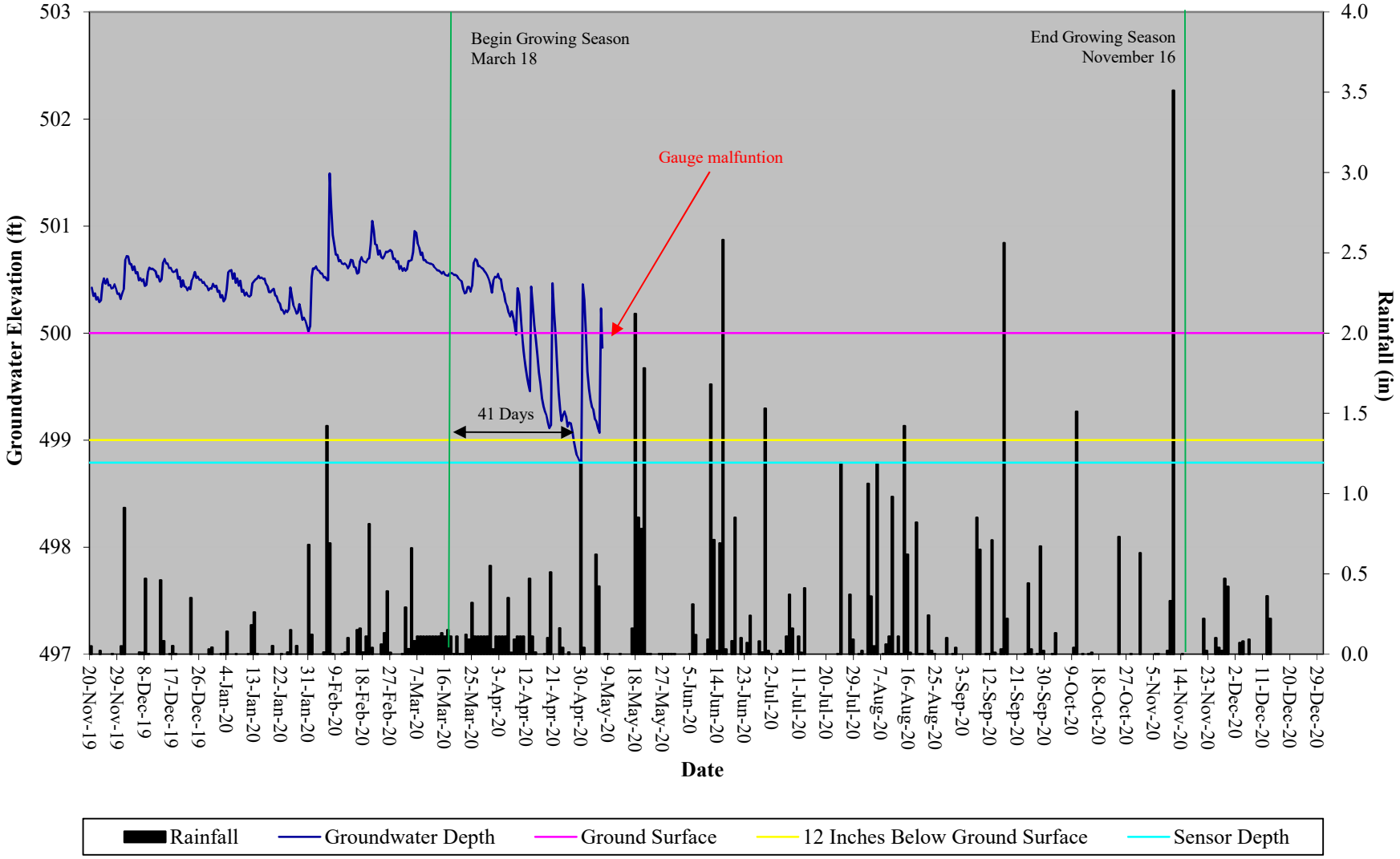
Bowl Basin Restoration Site
Hydrograph
Wetland Gauge 3



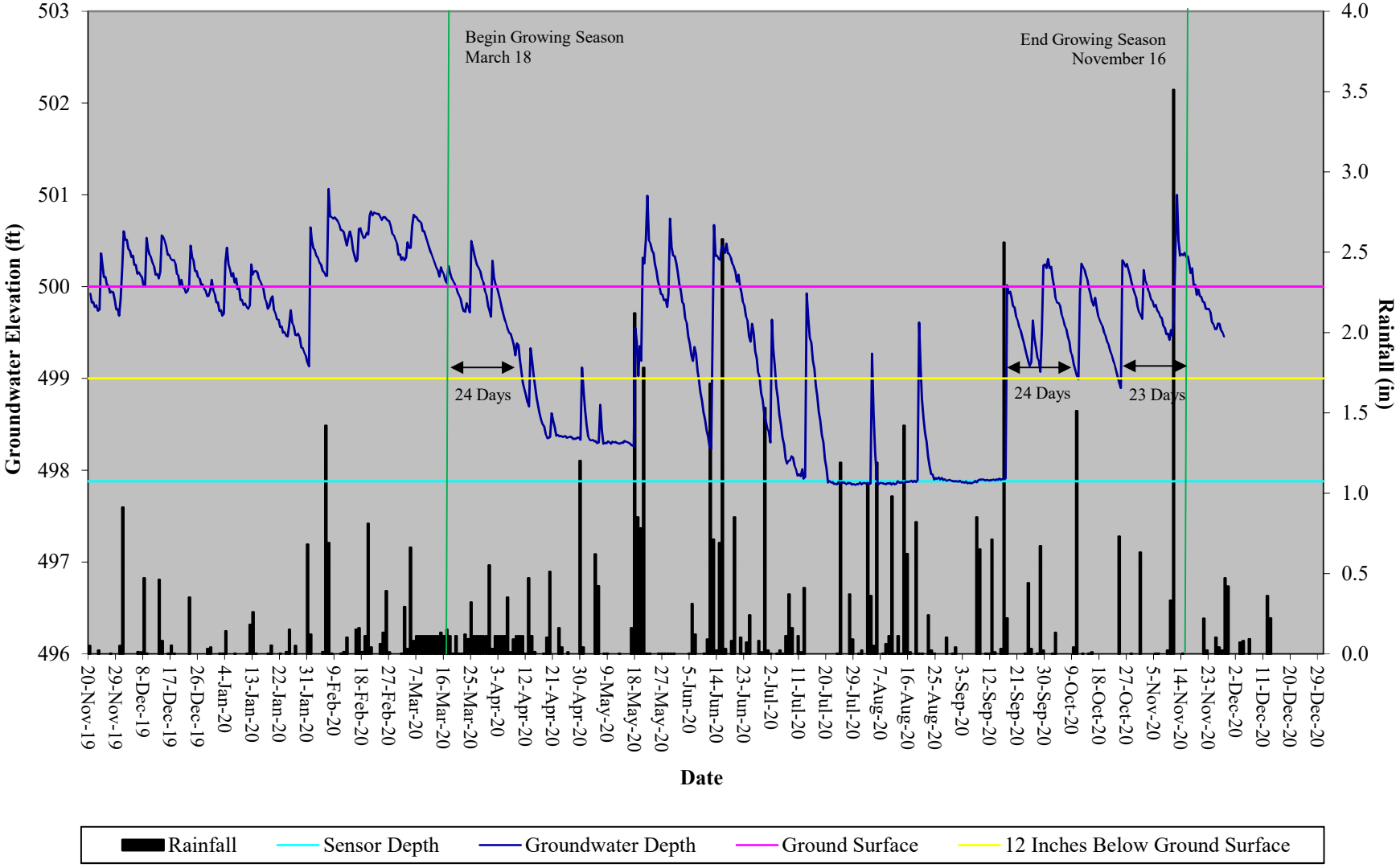

Bowl Basin Restoration Site
Hydrograph
Wetland Gauge 4
Begin Growing Season
March 18
End Growing Season
November 16
Gauge malfunction
18 Days
Groundwater Elevation (ft)
Rainfall (in)
Date
503
502
501
500
499
498
497
496
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
20-Nov-19
29-Nov-19
8-Dec-19
17-Dec-19
26-Dec-19
4-Jan-20
13-Jan-20
22-Jan-20
31-Jan-20
9-Feb-20
18-Feb-20
27-Feb-20
7-Mar-20
16-Mar-20
25-Mar-20
3-Apr-20
12-Apr-20
21-Apr-20
30-Apr-20
9-May-20
18-May-20
27-May-20
5-Jun-20
14-Jun-20
23-Jun-20
2-Jul-20
11-Jul-20
20-Jul-20
29-Jul-20
7-Aug-20
16-Aug-20
25-Aug-20
3-Sep-20
12-Sep-20
21-Sep-20
30-Sep-20
9-Oct-20
18-Oct-20
27-Oct-20
5-Nov-20
14-Nov-20
23-Nov-20
2-Dec-20
11-Dec-20
20-Dec-20
29-Dec-20
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth


Bowl Basin Restoration Site
Hydrograph
Wetland Gauge 5
Begin Growing Season
March 18
End Growing Season
November 16
Gauge malfunction
Groundwater Elevation (ft)
Rainfall (in)
Date
503
502
501
500
499
498
497
496
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
20-Nov-19
29-Nov-19
8-Dec-19
17-Dec-19
26-Dec-19
4-Jan-20
13-Jan-20
22-Jan-20
31-Jan-20
9-Feb-20
18-Feb-20
27-Feb-20
7-Mar-20
16-Mar-20
25-Mar-20
3-Apr-20
12-Apr-20
21-Apr-20
30-Apr-20
9-May-20
18-May-20
27-May-20
5-Jun-20
14-Jun-20
23-Jun-20
2-Jul-20
11-Jul-20
20-Jul-20
29-Jul-20
7-Aug-20
16-Aug-20
25-Aug-20
3-Sep-20
12-Sep-20
21-Sep-20
30-Sep-20
9-Oct-20
18-Oct-20
27-Oct-20
5-Nov-20
14-Nov-20
23-Nov-20
2-Dec-20
11-Dec-20
20-Dec-20
29-Dec-20
Rainfall
Sensor Depth
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface

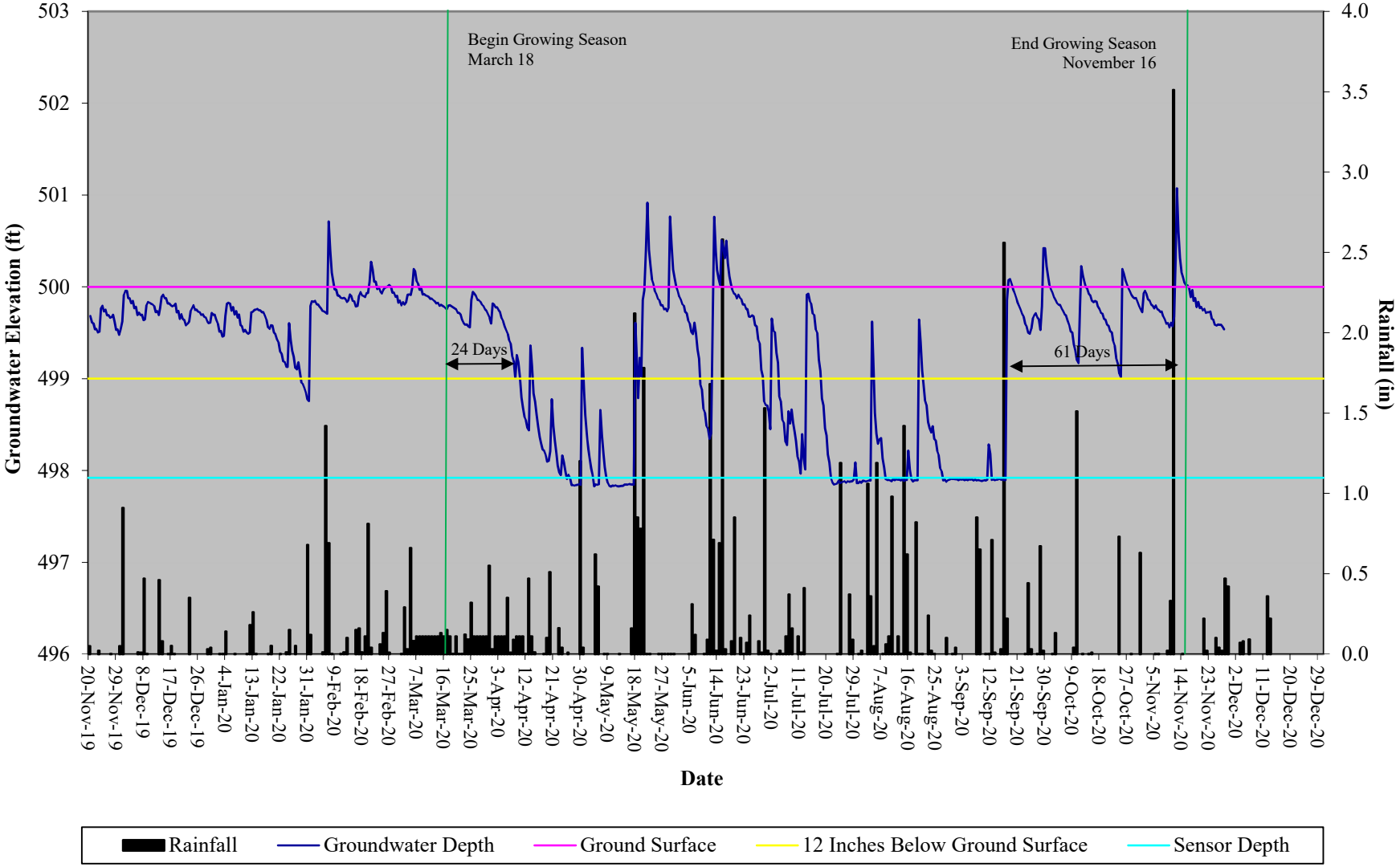
Bowl Basin Restoration Site
Hydrograph
Wetland Gauge 6



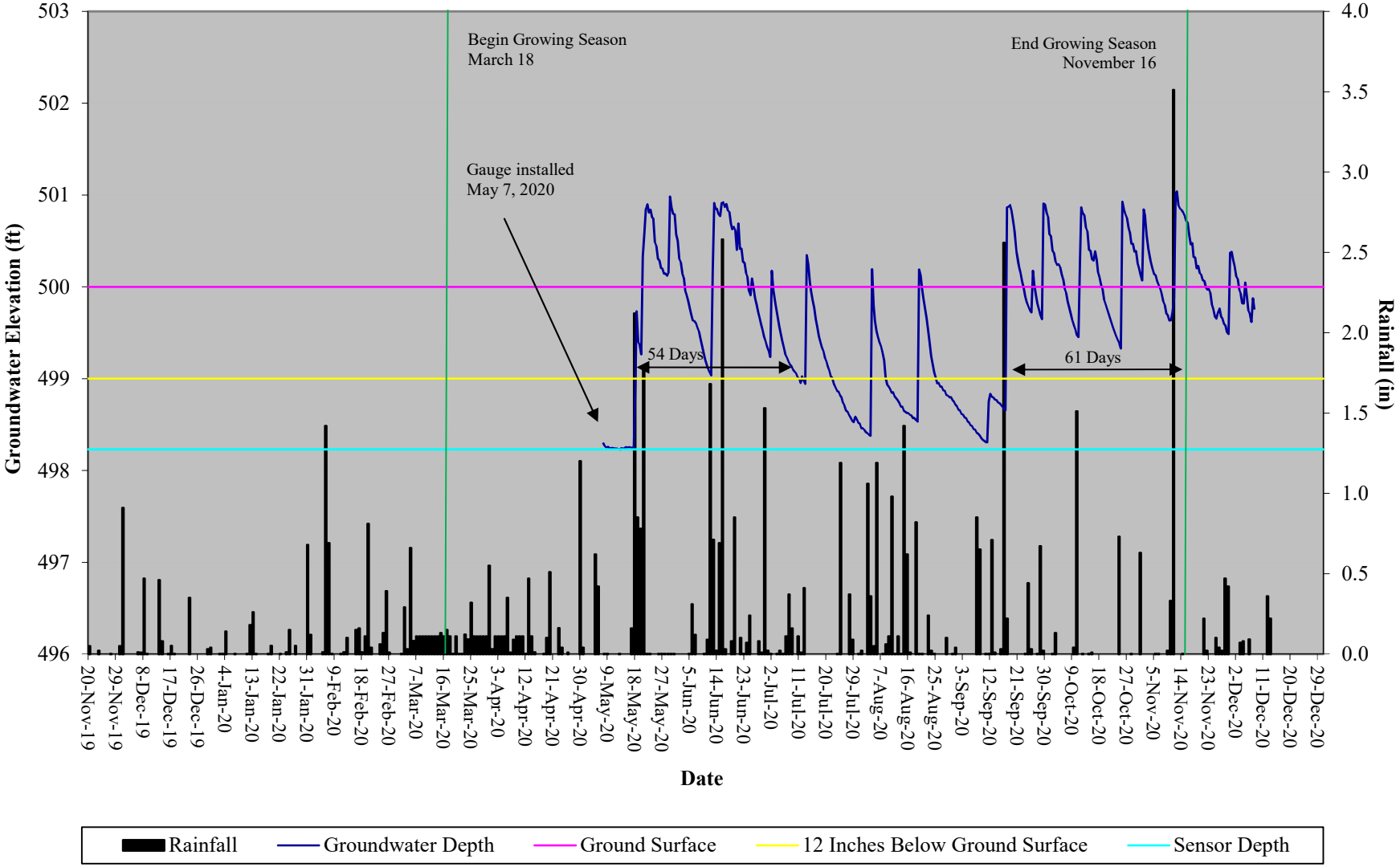
Bowl Basin Restoration Site
Hydrograph
Wetland Gauge 7



Bowl Basin Restoration Site
Hydrograph
Wetland Gauge 8



Bowl Basin Restoration Site
Hydrograph
Wetland Gauge 9



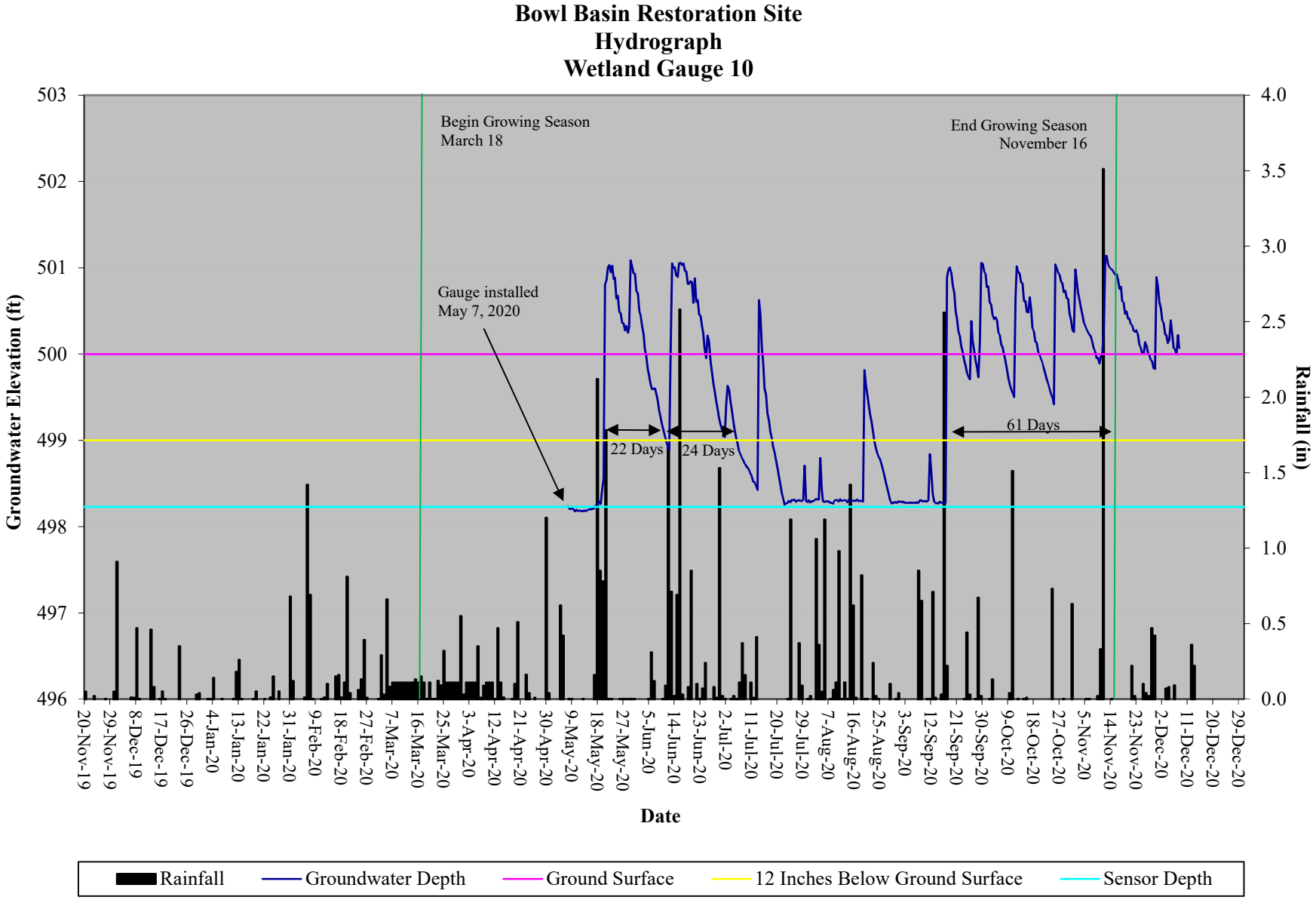

Bowl Basin Restoration Site
Hydrograph
Wetland Gauge 10
Groundwater Elevation (ft)
Rainfall (in)
Date
Begin Growing Season
March 18
End Growing Season
November 16
Gauge installed
May 7, 2020
22 Days
24 Days
61 Days
503
502
501
500
499
498
497
496
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
20-Nov-19
29-Nov-19
8-Dec-19
17-Dec-19
26-Dec-19
4-Jan-20
13-Jan-20
22-Jan-20
31-Jan-20
9-Feb-20
18-Feb-20
27-Feb-20
7-Mar-20
16-Mar-20
25-Mar-20
3-Apr-20
12-Apr-20
21-Apr-20
30-Apr-20
9-May-20
18-May-20
27-May-20
5-Jun-20
14-Jun-20
23-Jun-20
2-Jul-20
11-Jul-20
20-Jul-20
29-Jul-20
7-Aug-20
16-Aug-20
25-Aug-20
3-Sep-20
12-Sep-20
21-Sep-20
30-Sep-20
9-Oct-20
18-Oct-20
27-Oct-20
5-Nov-20
14-Nov-20
23-Nov-20
2-Dec-20
11-Dec-20
20-Dec-20
29-Dec-20
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth

Table 7. Wetland Hydrology Criteria Attainment Table
Project Number and Name: 95721 - Bowl Basin Restoration Site

	Success Criteria Achieved / Max Consecutive Days During Growing Season (Percentage)						
Non-Riparian Gauges Success Criteria (22 Days) (9%)	**MY-01 2015**	**MY-02 2016**	**MY-03 2017**	**MY-04 2018**	**MY-05 2019**	**MY-06 2020**	**MY-07**
Gauge 1	Yes/37 (15.2%)	Yes/29 (11.9%)	Yes/24 (9.8%)	Yes/35 (14.3%)	No/12 (4.9%)	No/18 (7.4%)	
Gauge 2	Yes/69 (28.3%)	Yes/49 (20.1%)	Yes/32 (13.1%)	Yes/37 (15.2%)	No/17 (7.0%)	Yes/22 (9.1%)	
Gauge 3	No/20 (8.2%)	Yes/27 (11.1%)	No/13 (5.3%)	Yes/27 (11.1%)	No/13 (5.3%)	No/14 (5.8%)	
Gauge 4	Yes/29 (11.9%)	Yes/41 (16.8%)	Yes/26 (10.7%)	Yes/32 (13.1%)	No/14 (5.7%)	No/18 (7.4%)	
Gauge 5	Yes/24 (9.8%)	Yes/52 (21.3%)	Yes/50 (20.5%)	Yes/36 (14.8%)	No/12 (4.9%)	No/5 (2.1%)	
Gauge 6	Yes/79 (32.4%)	Yes/60 (24.6%)	Yes/62 (25.4%)	Yes/58 (23.8%)	Yes/40 (16.4%)	Yes/41 (16.9%)	
Gauge 7	Yes/25 (10.2%)	Yes/38 (15.6%)	No/12 (4.9%)	Yes/31 (12.7%)	Yes/22 (9.0%)	Yes/24 (9.9%)	
Gauge 8	Yes/37 (15.2%)	Yes/51 (20.9%)	Yes/49 (20.1%)	Yes/40 (16.4%)	Yes/22 (9.0%)	Yes/61 (25.1%)	
Gauge 9*						Yes/61 (25.1%)	
Gauge 10*						Yes/61 (25.1%)	

*Gauge installed May 7, 2020