

**Bowl Basin Restoration Site
Monitoring Report MY04
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: 2018
Submitted: December 2018**

Monitoring and Design Firm



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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 is 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. Vegetation monitoring was not conducted in year four, per the mitigation plan, but will resume in year five.

During 2018, an area of densely growing sweetgum was treated. In this area sweetgum trees that were between 4 and 10 feet tall were cut and sprayed with herbicide. See Appendix B for more information.

2.2 HYDROLOGY MONITORING

Wetland hydrology is 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 “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 (243 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 243-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.

The daily rainfall data was obtained from a local weather station in Pumpkin Center, NC; provided by the NC State Climate Office. For the 2018 year, the months of April, May, June, July, August, and November experienced above average rainfall, while February and March recorded below average rainfall for the site. The months of January, September, and October experienced average rainfall. Overall, the area experienced above average rainfall during the 2018 growing season.

During the site’s fourth growing season, all of the 8 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).

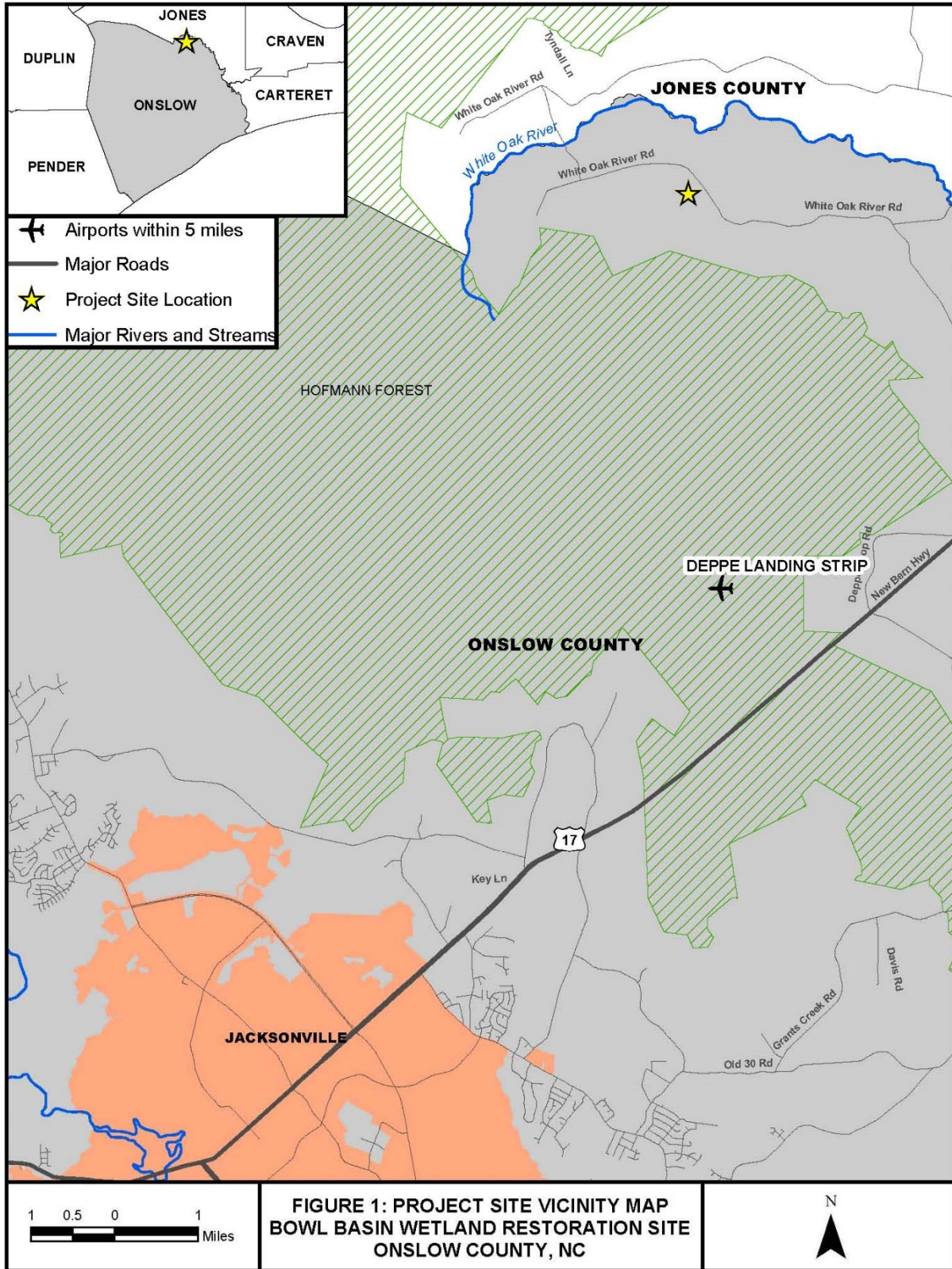
3.0 REFERENCES

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





- Easement Area (11.7 ac)
- Project Parcel
- Nonriparian Wetland Restoration
- Filled Ditches
- Disperse Flow from Ditch
- Ditch Re-Route Path



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

Image Source: NC 2010 Statewide Orthoimagery.

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| 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 | |
| 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 | |

| Table 3. Project Contacts | |
|---|---|
| Project Number and Name: 95721 - Bowl Basin Restoration Site | |
| Design Firm | KCI Associates of North Carolina, PC 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, PC 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

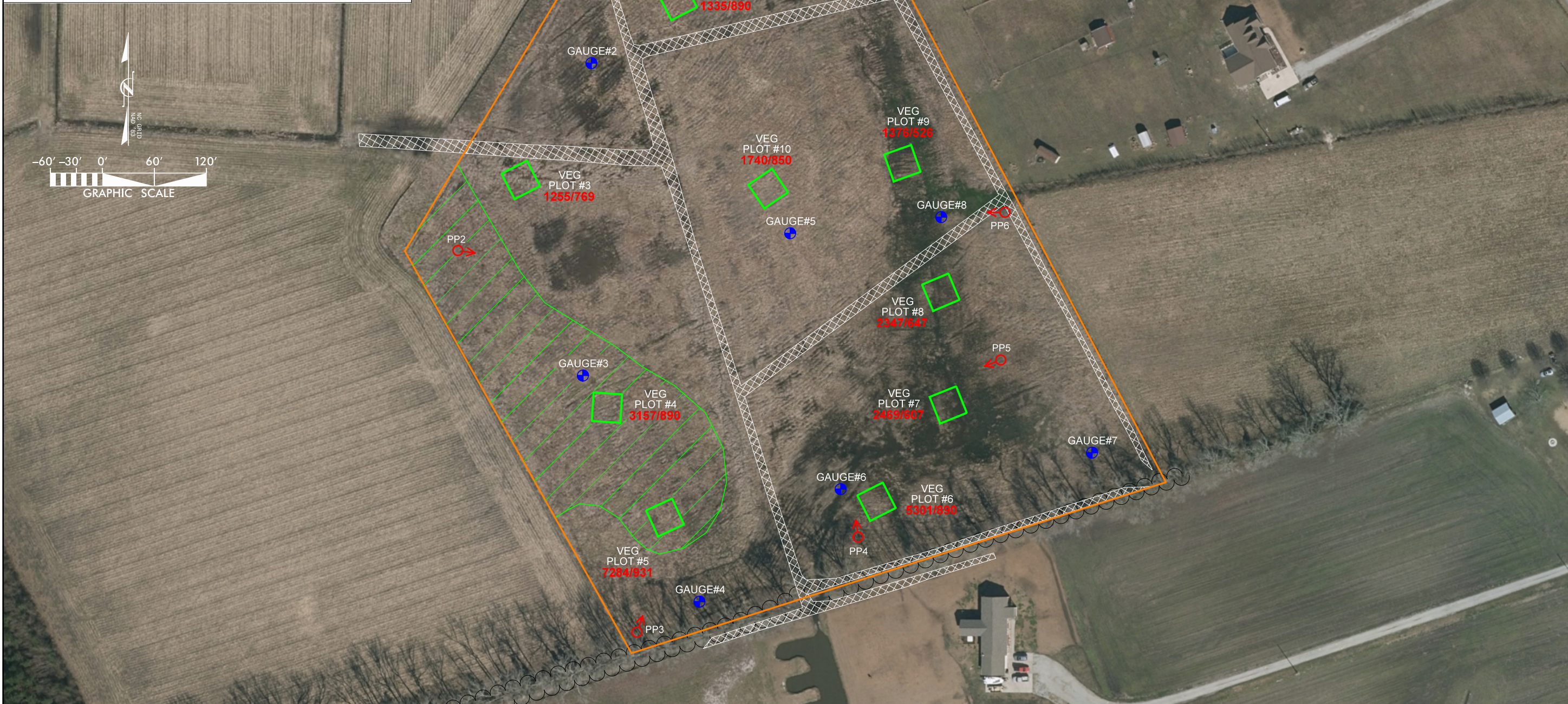
Visual Assessment Data

LEGEND:

- VEG PLOT ACHIEVING DENSITY CRITERION*
- VEG PLOT BELOW DENSITY CRITERION*
- VEG PLOT TOTAL / PLANTED STEM DENSITY* ----- **3072/773**
- 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

*Veg data from MY03 (2017)

IMAGE SOURCE: NC 2016 ORTHOIMAGERY



| SYL | 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 04

DATE: DEC 2018
 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 | Not Depicted, Covers Most of Restoration Area | 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. 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 – 5/25/15



PP1 – MY-04 – 11/13/18



PP2 – MY-00 – 5/25/15



PP2 – MY-04 – 11/13/18



PP3 – MY-00 – 5/25/15



PP3 – MY-04 – 11/13/18



PP4 – MY-00 – 5/25/15



PP4 – MY-04 – 11/13/18



PP5 – MY-00 – 5/25/15



PP5 – MY-04 – 11/13/18



PP6 – MY-00 – 5/25/15

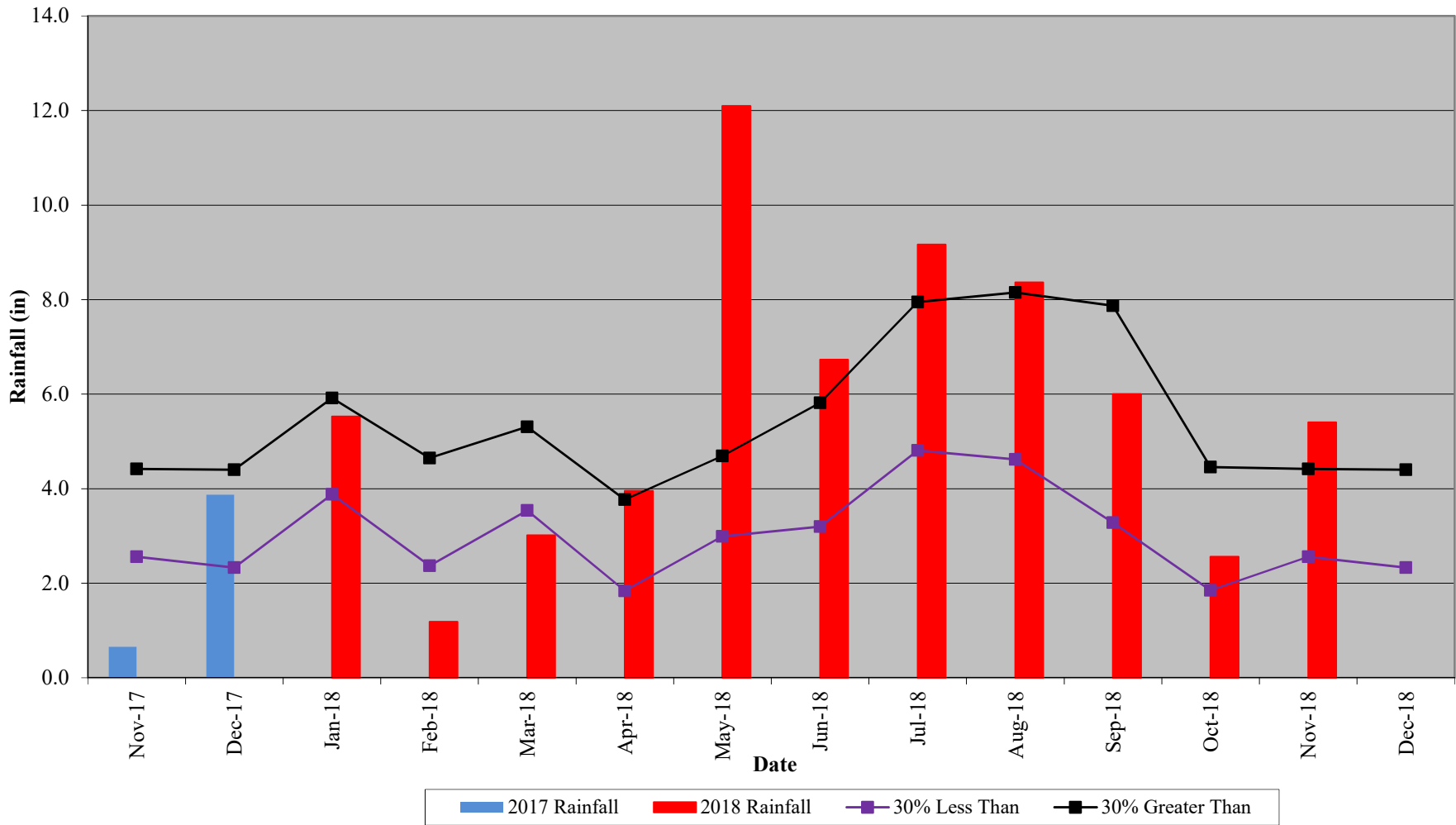


PP6 – MY-04 – 11/13/18

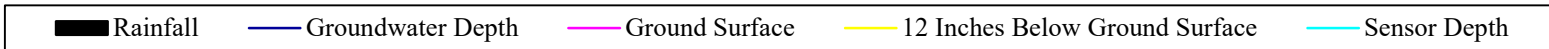
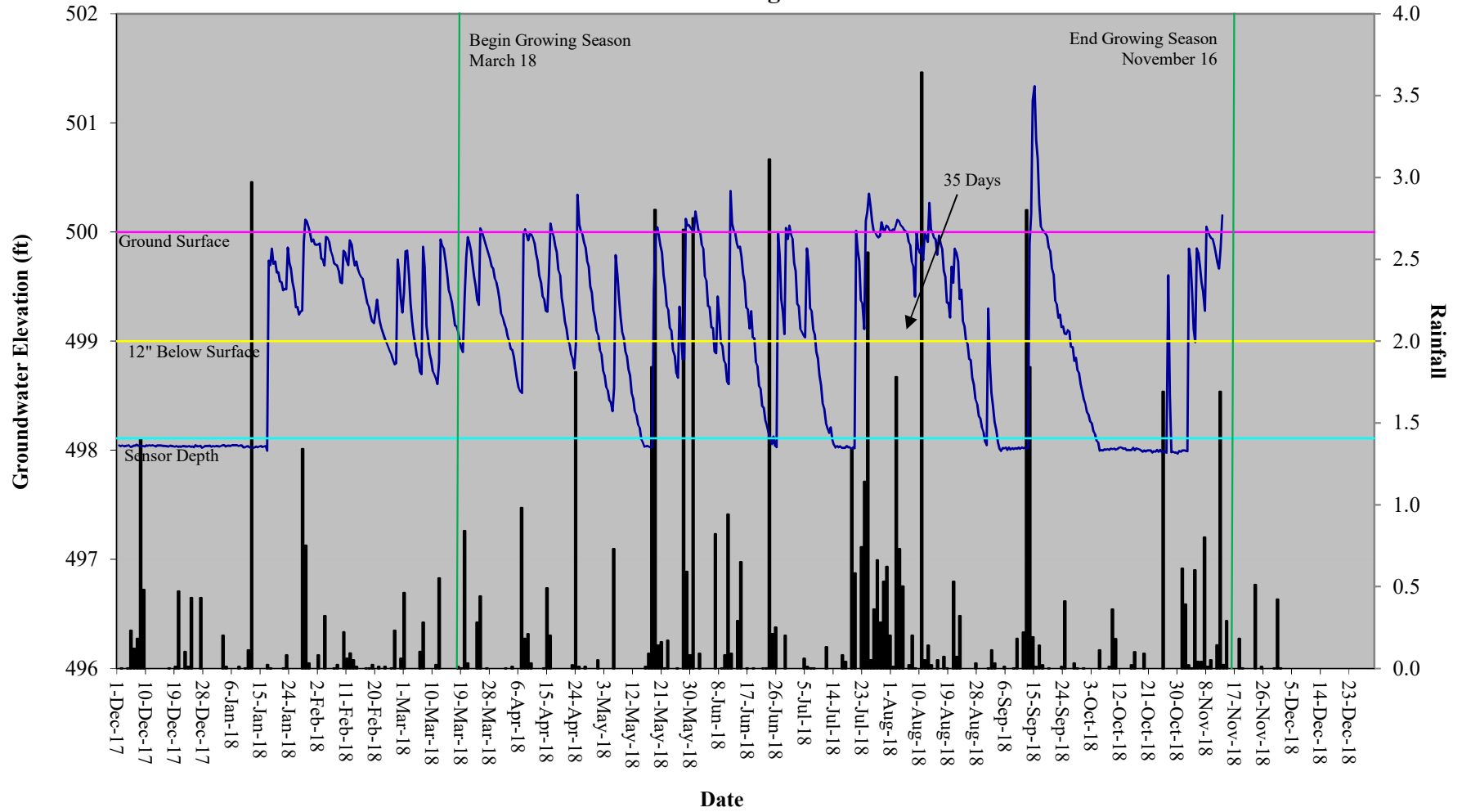
Appendix C

Hydrologic Data

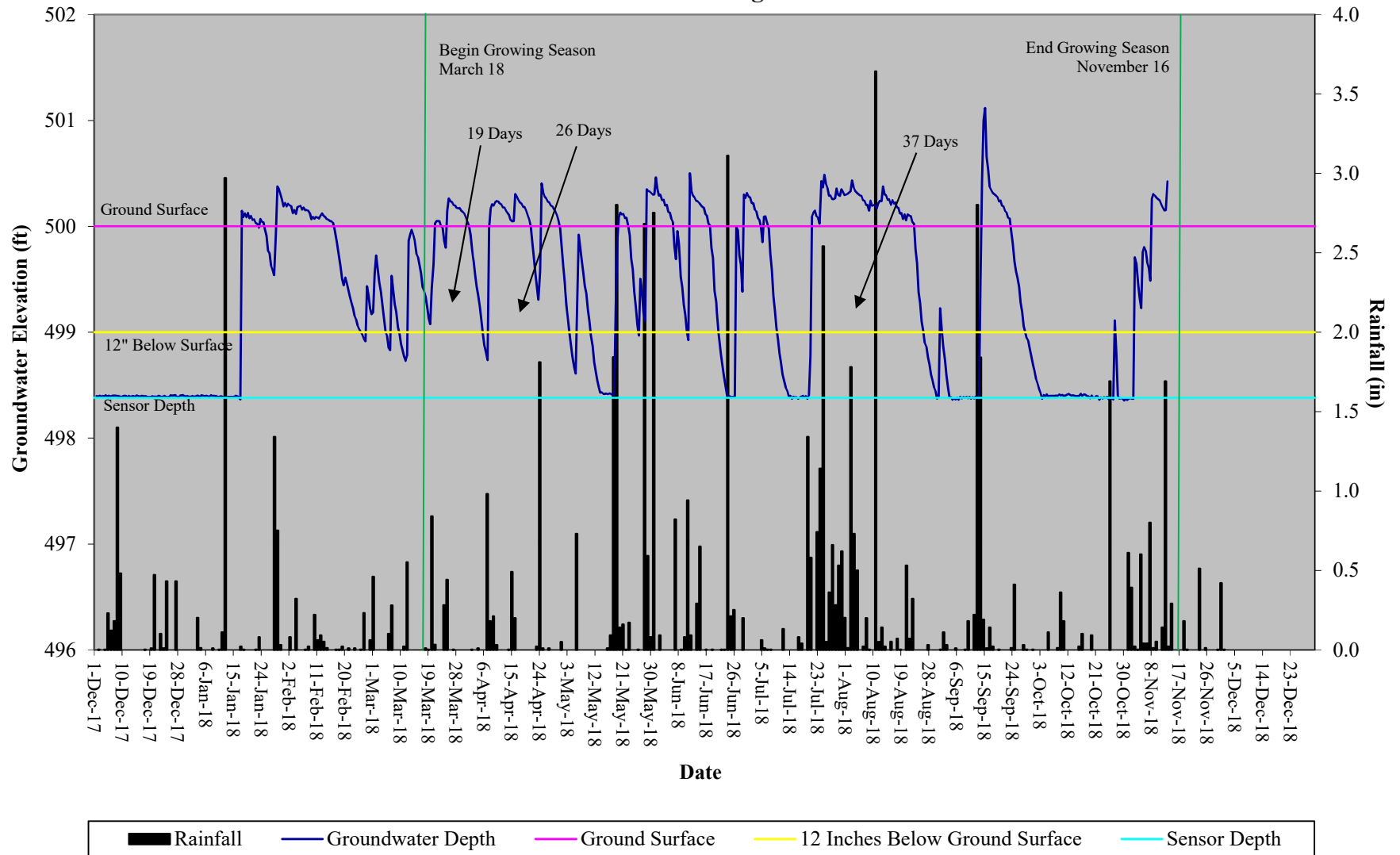
**Bowl Basin Wetland Restoration Site
30-70 Percentile Graph
WETS Station Name: Maysville, NC**



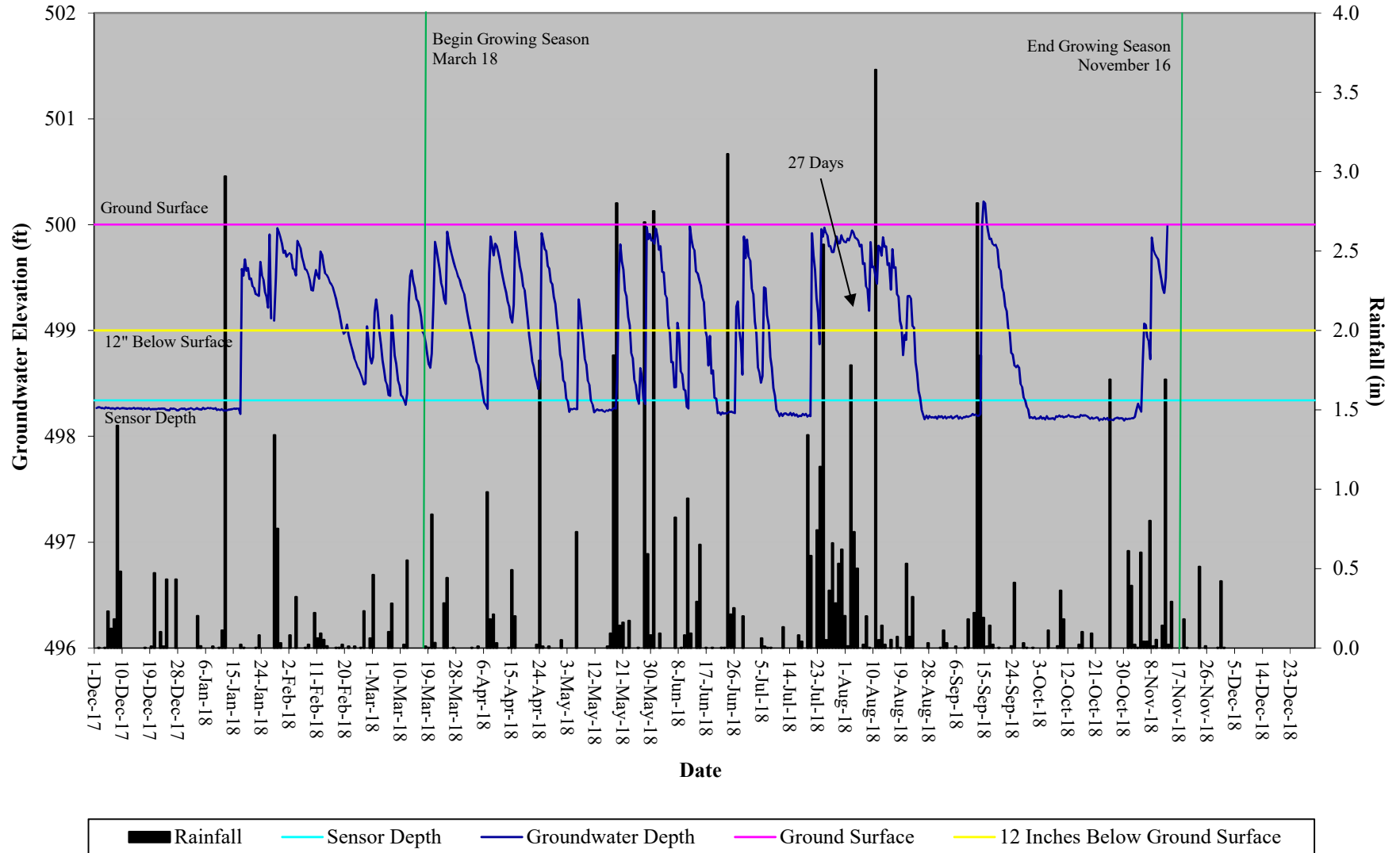
Bowl Basin Restoration Site Hydrograph Wetland Gauge 1



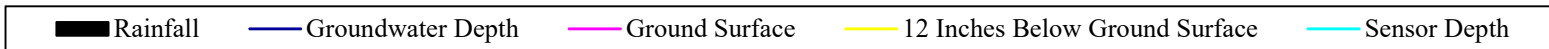
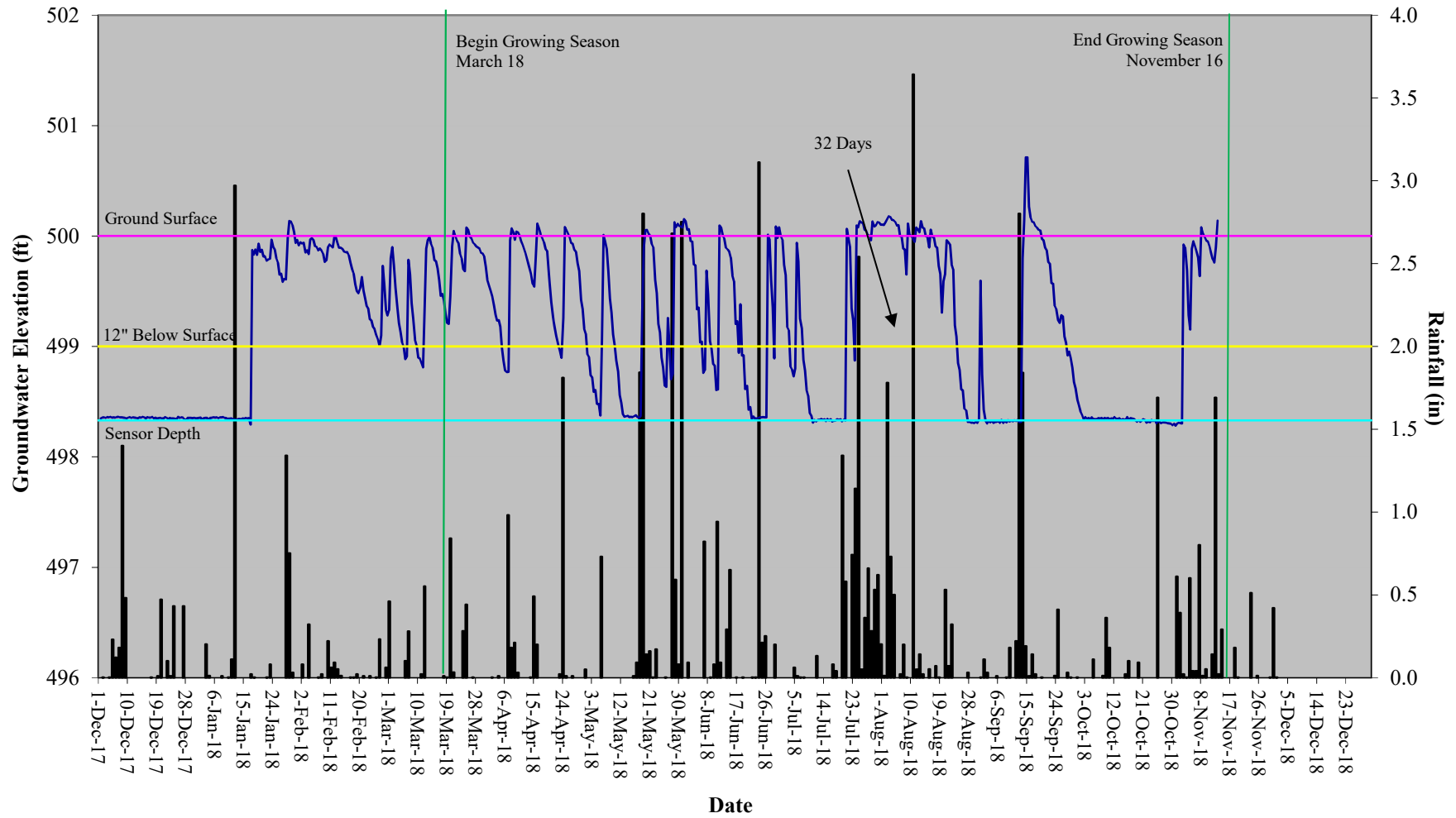
Bowl Basin Restoration Site Hydrograph Wetland Gauge 2



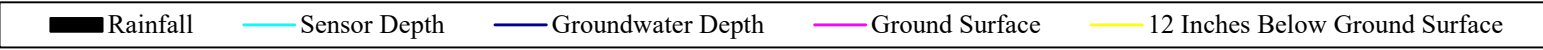
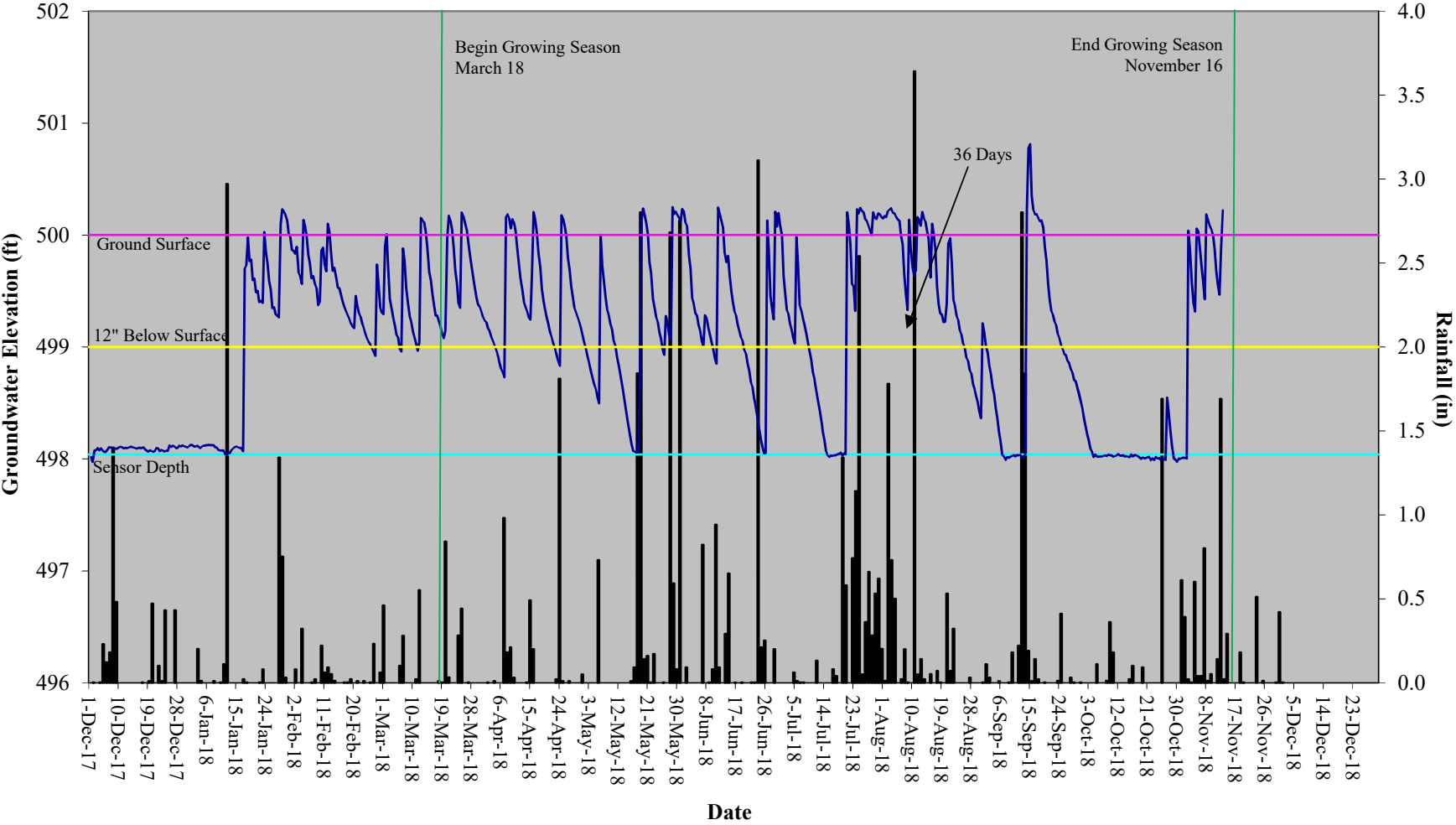
Bowl Basin Restoration Site Hydrograph Wetland Gauge 3



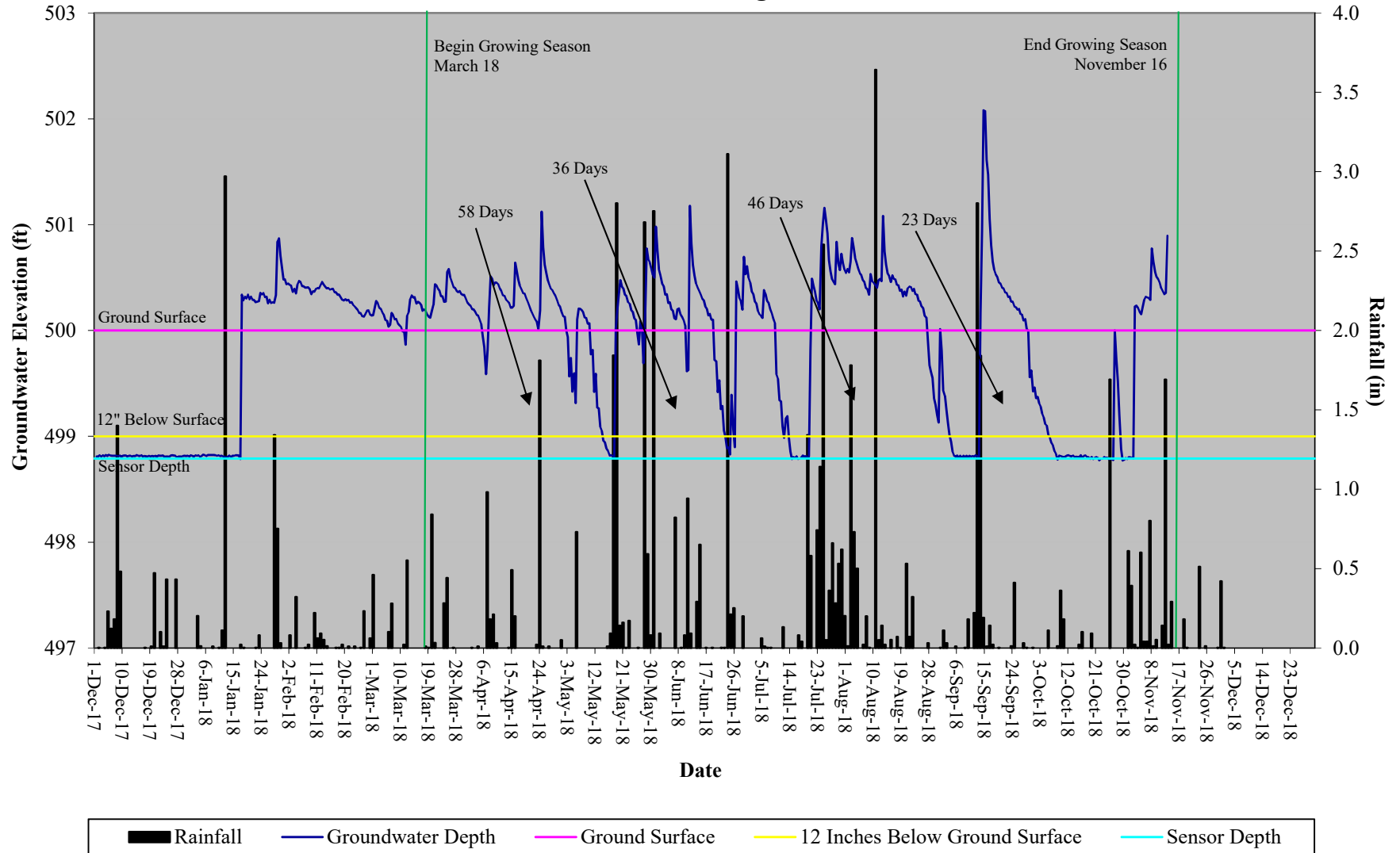
Bowl Basin Restoration Site Hydrograph Wetland Gauge 4



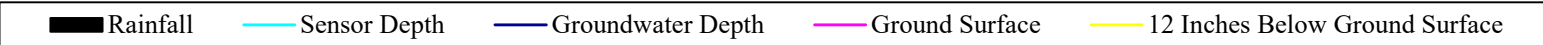
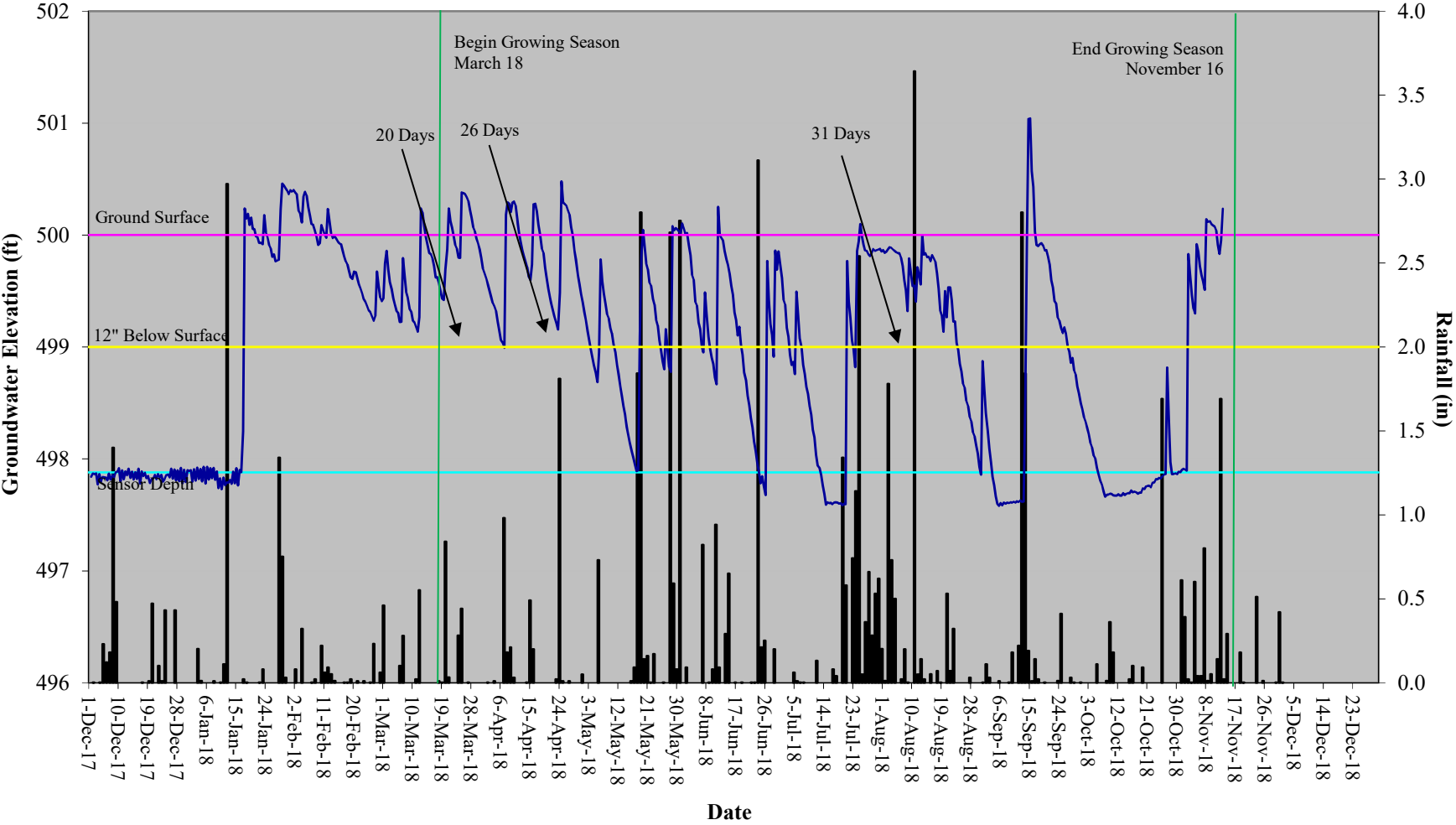
Bowl Basin Restoration Site Hydrograph Wetland Gauge 5



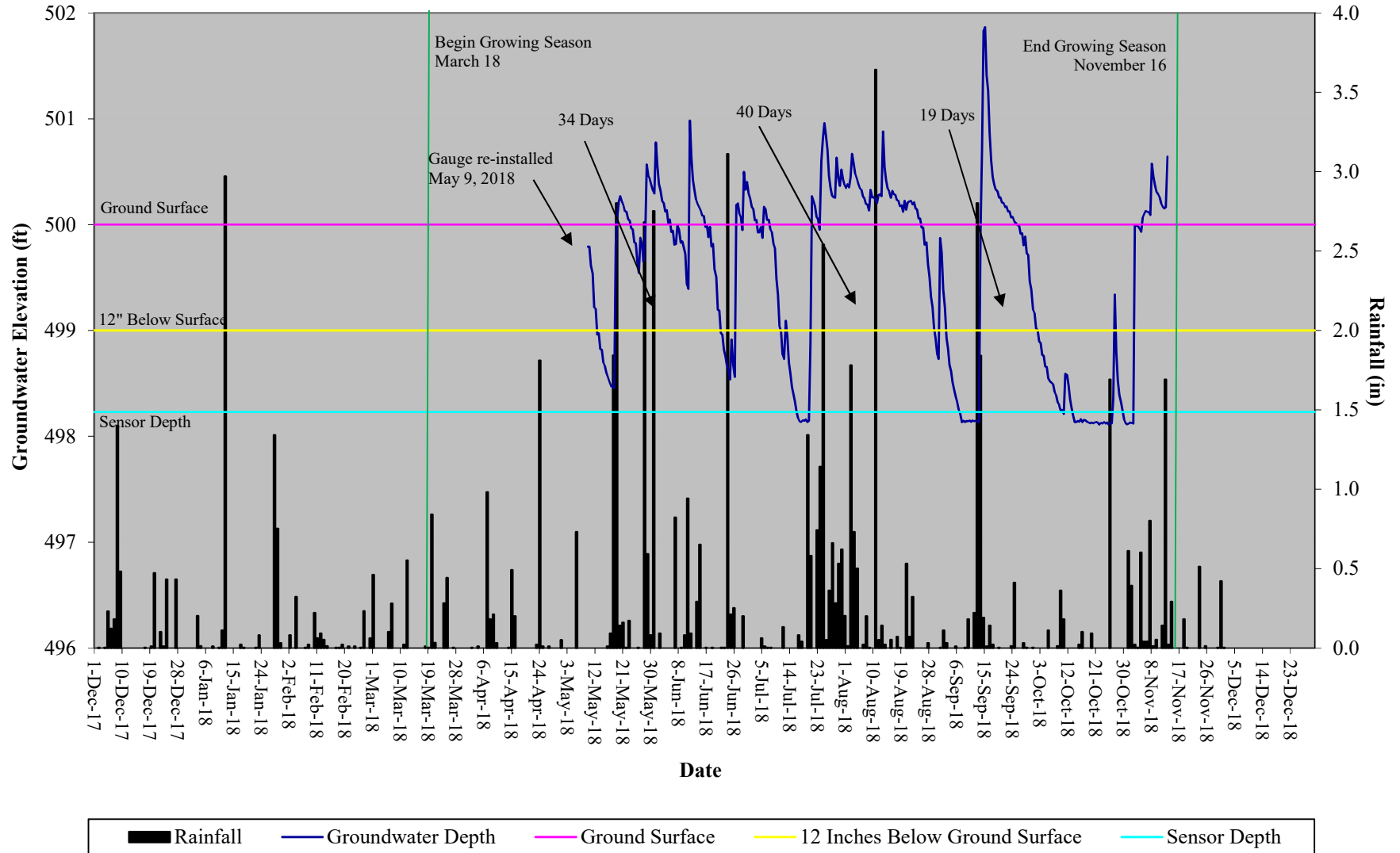
Bowl Basin Restoration Site Hydrograph Wetland Gauge 6



Bowl Basin Restoration Site Hydrograph Wetland Gauge 7



Bowl Basin Restoration Site Hydrograph Wetland Gauge 8



| Table 9. 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 | MY-06 | MY-07 |
| Gauge 1 | Yes/37 (15.0%) | Yes/29 (11.7%) | Yes/24 (9.9%) | Yes/35 (14.4%) | | | |
| Gauge 2 | Yes/69 (28.4%) | Yes/49 (20.0%) | Yes/32 (13.2%) | Yes/37 (15.2%) | | | |
| Gauge 3 | No/20 (8.2%) | Yes/27 (11.1%) | No/13 (5.3%) | Yes/27 (11.1%) | | | |
| Gauge 4 | Yes/29 (11.7%) | Yes/41 (16.9%) | Yes/26 (10.7%) | Yes/32 (13.2%) | | | |
| Gauge 5 | Yes/24 (9.9%) | Yes/52 (21.2%) | Yes/50 (20.6%) | Yes/36 (14.8%) | | | |
| Gauge 6 | Yes/79 (32.3%) | Yes/60 (24.5%) | Yes/62 (25.5%) | Yes/58 (23.9%) | | | |
| Gauge 7 | Yes/25 (10.3%) | Yes/48 (15.6%) | No/12 (4.9%) | Yes/31 (12.8%) | | | |
| Gauge 8 | Yes/37 (15.2%) | Yes/51 (21.0%) | Yes/49 (20.2%) | Yes/40 (16.5%) | | | |