Mitigation Project Name	Twin Bays	County	Duplin	USACE Action ID	2012-01385
DMS ID	95363	Date Project Instituted	7/27/2012	NCDWR Permit No	2013-0455
River Basin	Cape Fear	Date Prepared	5/22/2018		
Cataloging Unit	03030007				

Credit Release Milestone	Stream Credits						Wetland Credits							
	Scheduled Releases (Stream)	Warm	Cool	Cold	Anticipated Release Year (Stream)	Actual Release Date (Stream)	Scheduled Releases (Forested)	Riparian Riverine	Riparian Non-riverine	Non-riparian	Scheduled Releases (Coastal)	Coastal	Anticipated Release Year (Wetland)	Actual Release Date (Wetland)
Potential Credits (Mitigation Plan)										11.000				
Potential Credits (As-Built Survey)										10.600				
1 (Site Establishment)	N/A				N/A	N/A	N/A				N/A		N/A	N/A
2 (Year 0 / As-Built)	30%				N/A	N/A	30%			3.180	30%		2014	6/25/2014
3 (Year 1 Monitoring)	10%				N/A	N/A	10%			1.060	10%		2015	4/23/2015
4 (Year 2 Monitoring)	10%				N/A	N/A	10%			1.060	15%		2016	4/25/2016
5 (Year 3 Monitoring)	10%				N/A	N/A	10%			1.060	20%		2017	4/3/2017
6 (Year 4 Monitoring)	5%				N/A	N/A	10%			1.060	10%		2018	4/25/2018
7 (Year 5 Monitoring)	10%				N/A	N/A	10%				15%		2019	
8 (Year 6 Monitoring)	5%				N/A	N/A	10%				N/A		2020	
9 (Year 7 Monitoring)	10%				N/A	N/A	10%				N/A		2021	
Stream Bankfull Standard	10%				N/A	N/A	N/A				N/A			
Total Credits Released to Date										7.420				

DEBITS (released credits only)

Ratios			1	1.5	2.5	5	1	3	2	5	1	3	2	5	1	3	2	5
			Stream Restoration	Stream Enhancement I	Stream Enhancement II	Stream Preservation	Riparian Restoration	Riparian Creation	Riparian Enhancement	Riparian Preservation	Nonriparian Restoration	Nonriparian Creation	Nonriparian Enhancement	Nonriparian Preservation	Coastal Marsh Restoration	Coastal Marsh Creation	Coastal Marsh Enhancement	Coastal Marsh Preservation
As-Built Amounts (feet and acres)											10.600							
As-Built Amounts (mitigation credits)											10.600							
Percentage Released											70%							
Released Amounts (feet / acres)											7.420							
Released Amounts (credits)											7.420							
NCDWR Permit	USACE Action ID	Project Name																
2010-0459	2010-01735	Ponder Co. Surface Water Treatment & Finished Water Trans Main									0.480							
	2009-00748	Bunn Brantley									0.120							
2008-1555	2008-01720	Shelter Creek Quarry									3.640							
2008-1555	2008-01720	Shelter Creek Quarry									1.060							
2008-1555	2008-01720	Shelter Creek Quarry									0.800							
	2011-00079	Kennedy Broiler Farm									0.170							
	2011-01172	Grady Sanderson Farms Site									0.090							
	2011-01172	Grady Sanderson Farms Site									0.333							
	2011-01367	American Towers, LLC 273409									0.300							
	2012-01830	Dollar General N. College Road									0.425							
	2004-00944	Country Haven (Calson Violation)									0.002							
Remaining Amounts (feet / acres)											0.000							
Remaining Amounts (credits)											0.000							

Contingencies (if any): None

Signature of Wilmington District Official Approving Credit Release

9/6/18
Date

1 - For DMS, no credits are released during the first milestone
2 - For DMS projects, the second credit release milestone occurs automatically when the as-built report (baseline monitoring report) has been made available to the NCIRT by posting it to the NCEEP Portal, provided the following criteria have been met:
1) Approval of the 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) Reciept of necessary DA permit authorization or written DA approval for porjects 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

Monitoring Report

Twin Bays Wetland Restoration Site

Duplin County

DMS Contract 004739
DMS Project Number 95363

SAW-2012-01385, DWR-2013-0455

Monitoring Year 05

Prepared for:

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

Construction Completed: March 2014
Data Collection: 2018
Submitted: December 2018

Design and Monitoring Firm

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

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

PAT MCCRORY
Governor

DONALD R. VAN DER VAART
Secretary

Mitigation Services
ENVIRONMENTAL QUALITY

January 16, 2019

Adam Spiller
KCI Associates of NC

Sent via email to adam.spiller@kci.com

Subject: Monitoring Report Year 5 Comments for
Twin Bays, Project # 95363, Contract 004739
Cape Fear Basin – CU# 03030007, Duplin County, North Carolina

Mr. Spiller:

On January 12, 2017, the Division of Mitigation Services (DMS) received the Draft Monitoring Report for Bowl Basin and a site visit is planned for February 19th. After reviewing the document, please make the following updates to finalize:

- Please add the Project County, CU, DWR (DWR-2013-0455), and USACE (SAW-2012-01385) numbers for this project on the cover page.

Please submit 3 hard copies and an electronic copy of the final report.

Thanks for your work,

Lindsay Crocker, DMS

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY / PROJECT ABSTRACT

The Twin Bays Wetland Restoration Site, (TBWRS) completed in March 2014, restored 10.6 acres of non-riparian wetland along with 0.4 acre of upland preservation. The TBWRS is a non-riparian wetland system in the Cape Fear Basin (03030007 8-digit HUC) in southern Duplin County, North Carolina. The project is located in the 14-digit HUC 03030007090040 (Rock Fish Creek), which DMS has identified as a Targeted Local Watershed (TLW) (NCDENR, EEP 2009).

The project site is protected by an 11.72-acre permanent conservation easement held by the State of North Carolina. TBWRS is located on a single parcel located off of Cornwallis Road approximately two miles northwest of Wallace, North Carolina. The project site is bounded by Cornwallis Road to the west, a ditch along the property line to the south, and agricultural land to the east and north. Prior to construction, the site was actively used for row crop farming. The site had 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 TBWRS's 14-digit HUC are to expand restoration opportunities and repair riparian buffers (NCDENR EEP, 2009). The project goals for TBWRS are in line with the basin priorities and include the following:

- Slow and treat the runoff of upslope agricultural drainage.
- Restore a Hardwood Flats Community.
- Develop valuable wetland habitat niches within a drained agricultural landscape.

The project goals will be addressed through the following 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.
- Modify an existing pond to its natural seep condition to feed the downslope wetland.
- Restore a native forested hardwood wetland community using natives trees and seed mixes.

There are three non-credit generating areas on the site. There is 0.4-acre of uplands located in the forested northeastern corner of the project boundary. This area remained undisturbed and is included in the TBWRS conservation easement. There is a 0.2 acre utility easement on the west side of the site along Cornwallis Road that remained undisturbed. Additionally, the southernmost ditch, located adjacent to the project easement, was left open and not filled. It is anticipated that leaving this ditch open will have minimal impacts to the overall hydrologic performance of the site. The hydrologic influence of this ditch 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 76'. Due to the fact that the southern ditch 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 ditches and surface roughening, the entire site will have more surface and groundwater, which may decrease the effect of the ditch. For this reason, the non-credit generating portion of the site is assumed to be half of the zone of influence for the ditch.

The TBWRS provided mitigation for wetland impacts within Hydrologic Unit 03030007 by restoring 10.6 acres of wetland and preserving 0.4-acre of uplands, generating 10.6 riparian wetland mitigation units (WMU's). The TBWRS will be monitored to determine if the project is on-track to meeting jurisdictional wetland status. The wetland site will be deemed successful once hydrology is established and vegetation success criteria are met. During the site's fifth growing season, all ten vegetation

monitoring plots met the success criteria. All of the nineteen groundwater monitoring gauges also met the success criteria.

Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Report and in the Mitigation Plan documents available on the DMS website. All raw data supporting the tables and figures in the appendices are available from DMS upon request.

2.0 MONITORING RESULTS

The TBWRS will be monitored to determine if the project is on-track to meeting jurisdictional wetland status. The wetland restoration area 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.

2.1 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.

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 983 planted stems/acre. All ten plots had greater than 260 planted stems/acre. Including volunteers, the site averaged 1,489 total stems/acre. In general the site is well vegetated, with widespread herbaceous coverage and healthy planted stems.

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 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 Duplin 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 soil survey for Duplin County does not contain growing season data; therefore, due to its close proximity, the Sampson County soil survey was used. The estimated growing season begins March 18 and ends November 11 (239 days). The water table of the restored wetlands must be within 12" of the soils surface continuously for at least 8% (19 days) of the 239-day growing season. Wetland hydrology will be monitored with nineteen automatic gauges that record water table depth. Daily data is collected from the automatic gauges over the 7-year monitoring period.

To monitor the effect of the unfilled ditch described in Section 1.0, four sets of coupled gauges were installed perpendicular to the unfilled ditch. Each set includes a gauge that is 40' from the open ditch and another that is 75' from the ditch. An additional two gauges were installed between the coupled gauges to monitor hydrology less than 40' from the open ditch in the non-credit bearing zone.

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

During the site's fifth growing season, all of the seventeen of the credit-bearing gauges met the hydrologic success criteria. Additionally, both of the non-credit bearing gauges also achieved the success criteria this year.

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 13, 2018.

4.0 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. Lower Yadkin Pee-Dee River Basin Priorities 2009. Raleigh, NC. http://www.nceep.net/services/restplans/Yadkin_Pee_Dee_RBRP_2009_Final.pdf

NCSU BAE. North Carolina State University, Biological and Agricultural Engineering. 2011. Method to Determine Lateral Effect of a Drainage Ditch on Adjacent Wetland Hydrology. Last accessed 11/2012 at: http://www.bae.ncsu.edu/soil_water/projects/lateral_effect.html

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

Appendix A

Project Vicinity Map and Background Tables

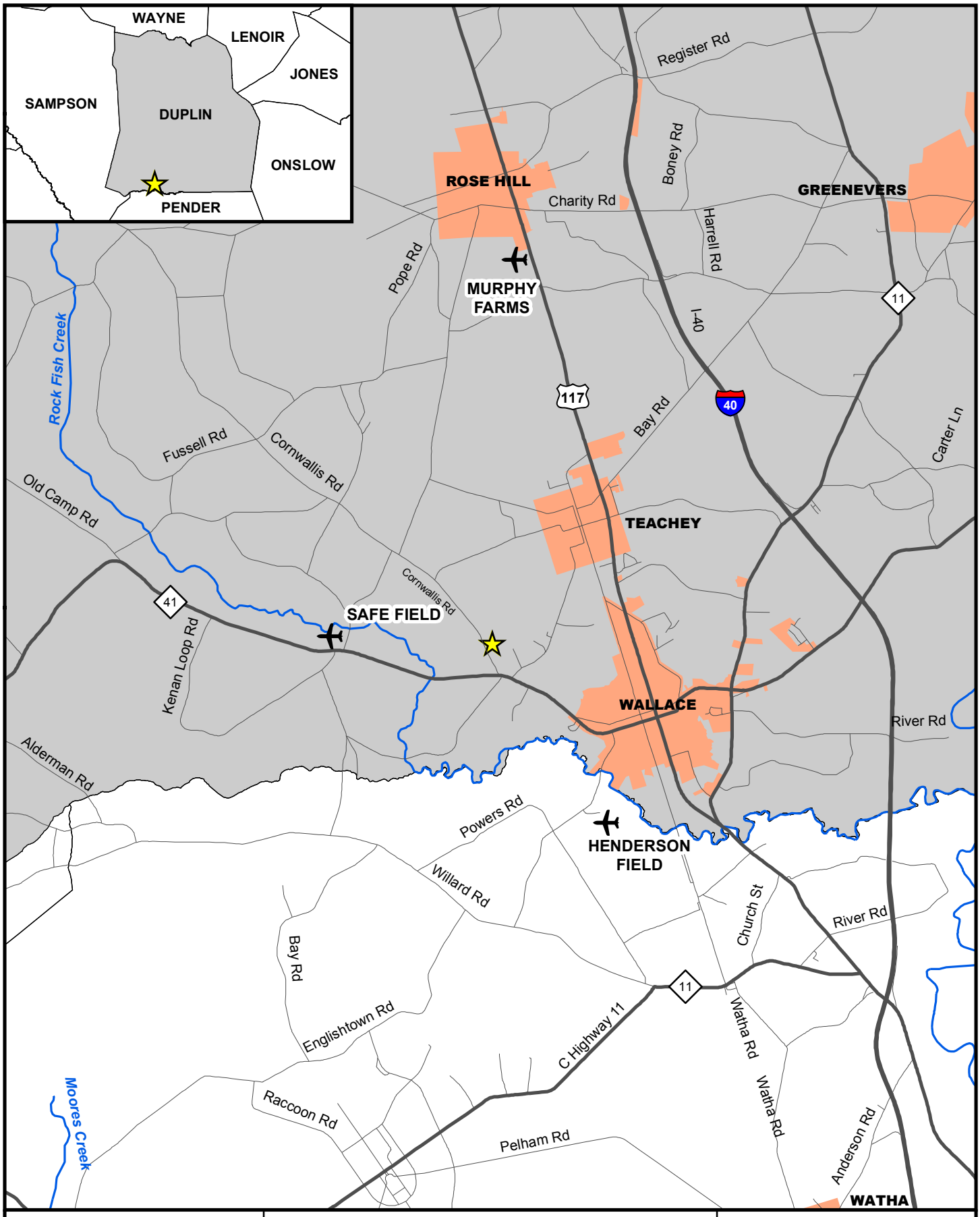


FIGURE 1. PROJECT SITE VICINITY MAP
TWIN BAYS WETLAND RESTORATION SITE
DUPLIN COUNTY, NC

Table 1. Project Components and Mitigation Credits									
Twin Bays Wetland Restoration Site, DMS Project # 95363									
Mitigation Credits									
	Stream		**Riparian Wetland**		**Non-riparian Wetland**		**Buffer**	**Nitrogen Nutrient Offset**	**Phosphorous Nutrient Offset**
Type	R	RE	R	RE	R	RE			
Acres					10.6				
Credits					10.6				
TOTAL CREDITS					10.6				
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	Central and Southern portion of project easement		10.6 acres		-		Restoration	10.6 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					10.6 acres				
Enhancement									
Enhancement I									
Enhancement II									
Creation									
Preservation									0.4 acre
High Quality Preservation									
TOTAL	**-**		**-**	**-**	**10.6 acres**			**-**	**0.4 acre**
TOTAL WMU	**-**		**-**	**-**	**10.6**			**-**	**-**

Table 2. Project Activity & Reporting History Twin Bays Wetland Restoration Site, DMS Project # 95363		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Mitigation Plan		Oct 2013
Final Design - Construction Plans		Dec 2013
Construction		Feb/March 2014
Planting		March 2014
Baseline Monitoring/Report	April 2014	May 2014
Vegetation Monitoring	April 10, 2014	
Photo Points	April 10, 2015	
Year 1 Monitoring	Nov 2014	Dec 2014
Vegetation Monitoring	Nov 3, 2014	
Photo Points	Nov 3, 2014	
Gauge Download	Nov 2017, 2014	
Supplemental Planting		March 2015
Year 2 Monitoring	Nov 2015	Jan 2016
Vegetation Monitoring	July 30, 2015	
Photo Points	July 30, 2015	
Gauge Download	Nov 25, 2015	
Year 3 Monitoring	Dec 2016	Dec 2016
Vegetation Monitoring	July 6, 2016	
Photo Points	Aug 23, 2016	
Gauge Download	Dec 14, 2016	
Year 4 Monitoring	Nov 2017	Dec 2017
Vegetation Monitoring	N/A	
Photo Points	Nov 30, 2017	
Gauge Download	Nov 30, 2017	
Year 5 Monitoring	Nov 2018	Dec 2018
Vegetation Monitoring	July 13, 2018	
Photo Points	Nov 13, 2018	
Gauge Download	Nov 13, 2018	

Table 3. Project Contacts **Twin Bays Wetland Restoration Site, DMS Project # 95363**	
Design Firm	KCI Associates of North Carolina, PA 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	Forestree Management Co. 1280 Maudis Road Bailey, NC 27807 Contact: Mr. Tony Cortez Phone: (252) 243-2513
Monitoring Performers	
	KCI Associates of North Carolina, PA 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 Information			
Twin Bays Wetland Restoration Site, DMS Project # 95363			
Project Name	Twin Bays Wetland Restoration Site		
County	Duplin County		
Project Area (acres)	11.72 acres		
Project Coordinates (lat. and long.)	34.748418 N , -78.027129 W		
Project Watershed Summary Information			
Physiographic Province	Coastal Plain		
River Basin	Cape Fear		
USGS Hydrologic Unit 8-digit	03030007	**USGS Hydrologic Unit 14-digit**	03030007090040
DWQ Sub-basin	18-74-29b		
Project Drainage Area (acres)	25.4 acres		
Project Drainage Area Percentage of Impervious Area	2%		
CGIA Land Use Classification	93% Cultivated, 2% Mixed Shrubland, and 5% Low-Intensity Development		
Wetland Summary Information (Post-Restoration)			
Parameters	**Wetland Area**		
Size of Wetland (acres)	10.6 acres		
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)	Non-riparian		
Mapped Soil Series	Rains (Torhunta, Murville/Leon and Udorthents by detailed soil investigation)		
Drainage class	Poorly drained		
Soil Hydric Status	Drained Hydric		
Source of Hydrology	Hillside seepage / precipitation		
Hydrologic Impairment	Ditching and Crops		
Native vegetation community	Hardwood Flats Community		
Percent composition of exotic invasive vegetation	0%		
Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States – Section 404	Yes	Yes, received 404 permit	N/A
Waters of the United States – Section 401	Yes	Yes, received 401 permit	N/A
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	No	N/A	FEMA Floodplain Checklist
Essential Fisheries Habitat*	No	N/A	N/A

Appendix B

Visual Assessment Data

LEGEND:

- CONSERVATION EASEMENT
- VEG PLOT ACHIEVING DENSITY CRITERION
- VEG PLOT BELOW DENSITY CRITERION
- VEG PLOT TOTAL / PLANTED STEM DENSITY ---------- **1489 / 983**
- WETLAND GAUGE ACHIEVING HYDROLOGIC CRITERION
- WETLAND GAUGE BELOW HYDROLOGIC CRITERION
- PHOTO POINT

IMAGE SOURCE: NC 2016 ORTHOIMAGERY

NC GRID NAD 83

–50′ –25′ 0′ 50′ 100′

GRAPHIC SCALE

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

TWIN BAYS
WETLAND RESTORATION SITE

DMS PROJECT #95363
WALLACE, DUPLIN COUNTY, NORTH CAROLINA
MONITORING YEAR 05

DATE: DEC 2018
SCALE: GRAPHIC

CURRENT CONDITION PLAN VIEW

SHEET 1 OF 1

Table 5. Vegetation Condition Assessment
Twin Bays Restoration Site, DMS Project #95363

Planted Acreage 10.6 **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 acre	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acre	Pattern and Color	0	0.00	0.0%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acre	Pattern and Color	0	0.00	0.0%
			Cumulative Total	0	0.00	0.0%
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1,000 SF	Pattern and Color	0	0.00	0.0%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	none	Pattern and Color	0	0.00	0.0%

Photo Reference Points

PP1a – MY-00 – 4/10/14

PP1a – MY05 – 11/13/18

PP1b– MY-00 – 4/10/14

PP1b – MY05 – 11/13/18

PP2a – MY-00 – 4/10/14

PP2a – MY05 – 11/13/18

PP2b – MY-00 – 4/10/14

PP2b – MY05 – 11/13/18

PP3 – MY-00 – 4/10/14

PP3 – MY05 – 11/13/18

PP4a – MY-00 – 4/10/14

PP4a – MY05 – 11/13/18

PP4b – MY-00 – 4/10/14

PP4b – MY05 – 11/13/18

PP5a – MY-00 – 4/10/14

PP5a – MY05 – 11/13/18

PP5b – MY-00 – 4/10/14

PP5b – MY05 – 11/13/18

PP6a – MY-00 – 4/10/14

PP6a – MY05 – 11/13/18

PP6b– MY-00 – 4/10/14

PP6b – MY05 – 11/13/18

Vegetation Plot Photos

Veg Plot #1 – MY05 – 7/13/18

Veg Plot #2 – MY05 – 7/13/18

Veg Plot #3 – MY05 – 7/13/18

Veg Plot #4 – MY05 – 7/13/18

Veg Plot #5 – MY05 – 7/13/18

Veg Plot #6 – MY05 – 7/13/18

Veg Plot #7 – MY05 – 7/13/18

Veg Plot #8 – MY05 – 7/13/18

Veg Plot #9 – MY05 – 7/13/18

Veg Plot #10 – MY05 – 7/13/18

Appendix C

Vegetation Plot Data

Table 6. Vegetation Plot Criteria Attainment Twin Bays Restoration Site DMS Project #95363			
Vegetation Plot ID	**Vegetation Survival Threshold Met?**	**Monitoring Year 05 Planted Stem Density (stems/acre)**	**Monitoring Year 05 Total Stem Density (stems/acre)**
1	Yes	971	1,457
2	Yes	971	1,781
3	Yes	647	1,295
4	Yes	1,093	1,862
5	Yes	971	1,538
6	Yes	1,578	1,862
7	Yes	850	1,093
8	Yes	647	1,052
9	Yes	1,214	1,821
10	Yes	890	1,214

Table 7. CVS Vegetation Plot Metadata Twin Bays Restoration Site DMS Project #95363	
Report Prepared By	Drew Rosso
Date Prepared	7/26/2018 15:32
database name	KCI-2015-95363_Twin Bays.mdb
database location	M:\2012\20122265 TwinBays\Monitoring\Vegetation CVS Database
computer name	12-3ZV4FP1
file size	62296064
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	95363
project Name	Twin Bays Restoration Site
Description	Wetland restoration site
River Basin	Cape Fear
area (sq m)	24523.92
Required Plots (calculated)	10
Sampled Plots	10

Table 8. CVS Stem Count Total and Planted by Plot and Species
DMS Project Code 95363. Project Name: Twin Bays Restoration Site

			Current Plot Data (MY5 2018)																												
			95363-01-0001			95363-01-0002			95363-01-0003			95363-01-0004			95363-01-0005			95363-01-0006			95363-01-0007			95363-01-0008			95363-01-0009			95363-01-0010		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree			6			8	1	1	6			1			5						1	2	2	4						1
Aronia arbutifolia	Red Chokeberry	Shrub				5	5	5							2	2	2													1	1	1
Baccharis	baccharis	Shrub						10						1			1						1			1			1			1
Baccharis halimifolia	eastern baccharis	Shrub																														
Betula nigra	river birch	Tree	5	5	5				1	1	1	4	4	4	6	6	6	16	16	16				1	1	1	5	5	5	11	11	11
Diospyros virginiana	common persimmon	Tree																														
Fraxinus pennsylvanica	green ash	Tree				11	11	11	1	1	1	2	2	2				9	9	9	2	2	2	1	1	1						
Juglans nigra	black walnut	Tree																								1						
Liquidambar styraciflua	sweetgum	Tree			2			2																								
Liriodendron tulipifera	tuliptree	Tree							2	2	2																					
Magnolia virginiana	sweetbay	Tree							1	1	1				6	6	6	3	3	3	6	6	6									
Nyssa biflora	swamp tupelo	Tree																											2			
Pinus taeda	loblolly pine	Tree			4						11			17			6						4									
Platanus occidentalis	American sycamore	Tree															1	3	3	3						6						
Quercus michauxii	swamp chestnut oak	Tree	6	6	6	4	4	4	6	6	6	8	8	8	3	3	3	7	7	7	13	13	13	10	10	10	2	2	2			
Quercus pagoda	cherrybark oak	Tree										11	11	11	1	1	1										3	3	11	5	5	6
Quercus palustris	pin oak	Tree																									1	1	1			
Quercus phellos	willow oak	Tree	4	4	4							2	2	2	2	2	2										9	9	10	3	3	3
Salix nigra	black willow	Tree															1			7												3
Sambucus	elderberry	Shrub																											2			
Sambucus canadensis	Common Elderberry	Shrub																														
Taxodium distichum	bald cypress	Tree	6	6	6																			1	1	1	9	9	10	2	2	2
Ulmus americana	American elm	Tree																														
Unknown		Shrub or Tree																														
Vaccinium corymbosum	highbush blueberry	Shrub	3	3	3	4	4	4	4	4	4				4	4	4	1	1	1				1	1	1	1	1	1			2
		Stem count	24	24	36	24	24	44	16	16	32	27	27	46	24	24	38	39	39	46	21	21	27	16	16	26	30	30	45	22	22	30
		size (ares)	1			1			1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	5	5	8	4	4	7	7	7	8	5	5	8	7	7	12	6	6	7	3	3	6	6	6	9	7	7	10	5	5	9
		Stems per ACRE	971	971	1457	971	971	1781	647	647	1295	1093	1093	1862	971	971	1538	1578	1578	1862	850	850	1093	647	647	1052	1214	1214	1821	890	890	1214

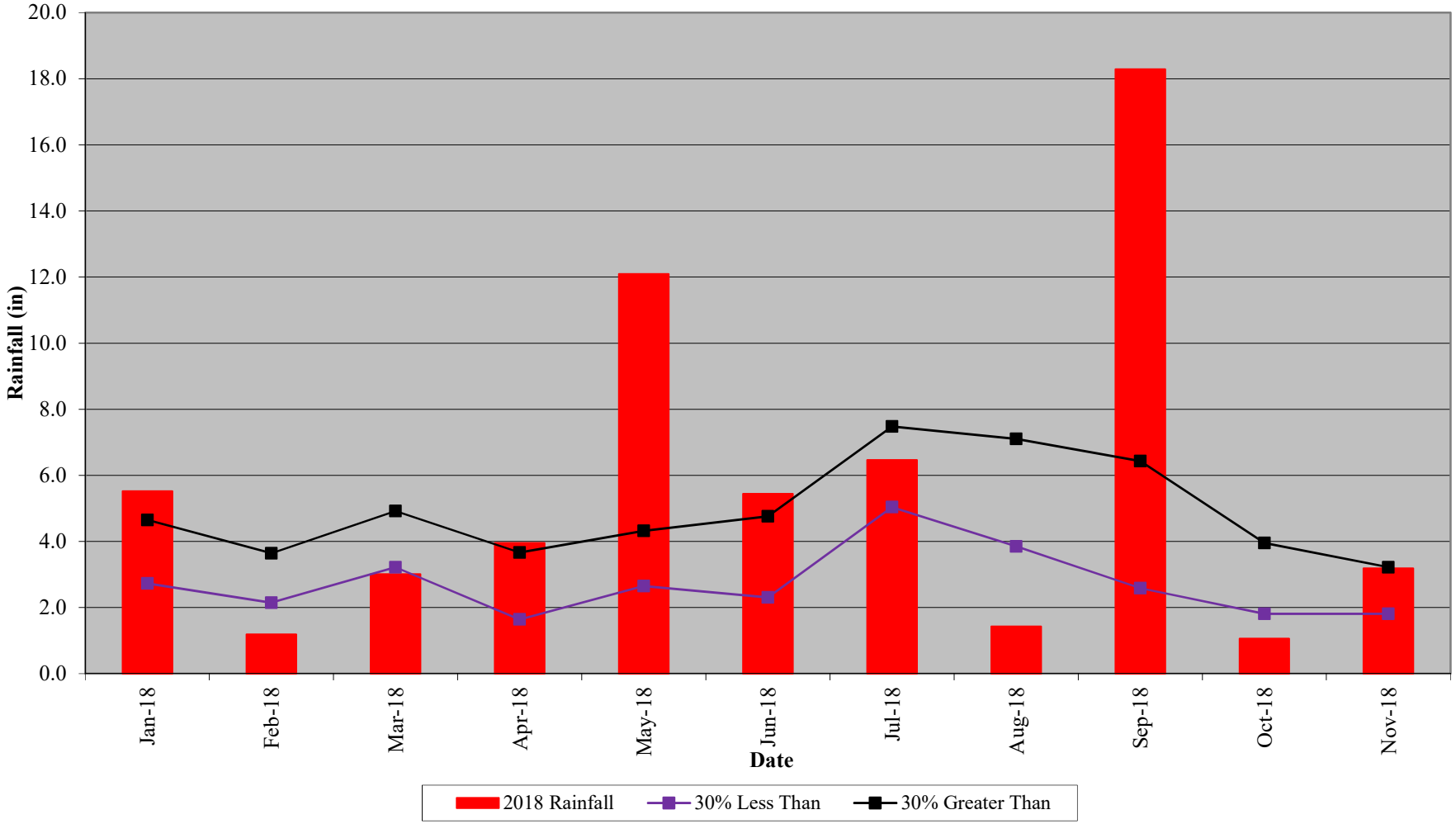
Table 8. CVS Stem Count Total and Planted by Plot and Species
DMS Project Code 95363. Project Name: Twin Bays Restoration Site

Annual Means																	
			MY5 (2018)			MY3 (2016)			MY2 (2015)			MY1 (2014)			MY0 (2014)		
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 rubrum	red maple	Tree	3	3	32	3	3	9	3	3	9	3	3	7	5	5	5
Aronia arbutifolia	Red Chokeberry	Shrub	8	8	8	8	8	11	7	7	7	8	8	8	11	11	11
Baccharis	baccharis	Shrub			16			12									
Baccharis halimifolia	eastern baccharis	Shrub						2			11			7			
Betula nigra	river birch	Tree	49	49	49	49	49	49	48	48	48	48	48	48	47	47	47
Diospyros virginiana	common persimmon	Tree						1									
Fraxinus pennsylvanica	green ash	Tree	26	26	26	25	25	25	26	26	26	24	24	24	5	5	5
Juglans nigra	black walnut	Tree			1												
Liquidambar styraciflua	sweetgum	Tree			4			1			1			1			
Liriodendron tulipifera	tuliptree	Tree	2	2	2	3	3	3	3	3	3	1	1	1	18	18	18
Magnolia virginiana	sweetbay	Tree	16	16	16	15	15	15	15	15	15	13	13	13	17	17	17
Nyssa biflora	swamp tupelo	Tree									5						
Pinus taeda	loblolly pine	Tree			42			2									
Platanus occidentalis	American sycamore	Tree	3	3	10	3	3	4	3	3	7	3	3	3			
Quercus michauxii	swamp chestnut oak	Tree	59	59	59	59	59	59	59	59	59	54	54	54			
Quercus pagoda	cherrybark oak	Tree	20	20	29	21	21	23	21	21	22	23	23	23	22	22	22
Quercus palustris	pin oak	Tree	1	1	1	1	1	1									
Quercus phellos	willow oak	Tree	20	20	21	20	20	20	20	20	20	9	9	9			
Salix nigra	black willow	Tree			11			7			2			3			
Sambucus	elderberry	Shrub			2												
Sambucus canadensis	Common Elderberry	Shrub									3						
Taxodium distichum	bald cypress	Tree	18	18	19	18	18	18	16	16	16	6	6	6	1	1	1
Ulmus americana	American elm	Tree													8	8	8
Unknown		Shrub or Tree										10	10	10	104	104	104
Vaccinium corymbosum	highbush blueberry	Shrub	18	18	20	19	19	19	22	22	22	20	20	20	22	22	22
		Stem count	243	243	368	244	244	281	243	243	276	222	222	237	260	260	260
		size (ares)	10			10			10			10			10		
		size (ACRES)	0.25			0.25			0.25			0.25			0.25		
		Species count	13	13	19	13	13	19	12	12	17	13	13	16	11	11	11
		Stems per ACRE	983	983	1489	987	987	1137	983	983	1117	898	898	959	1052	1052	1052

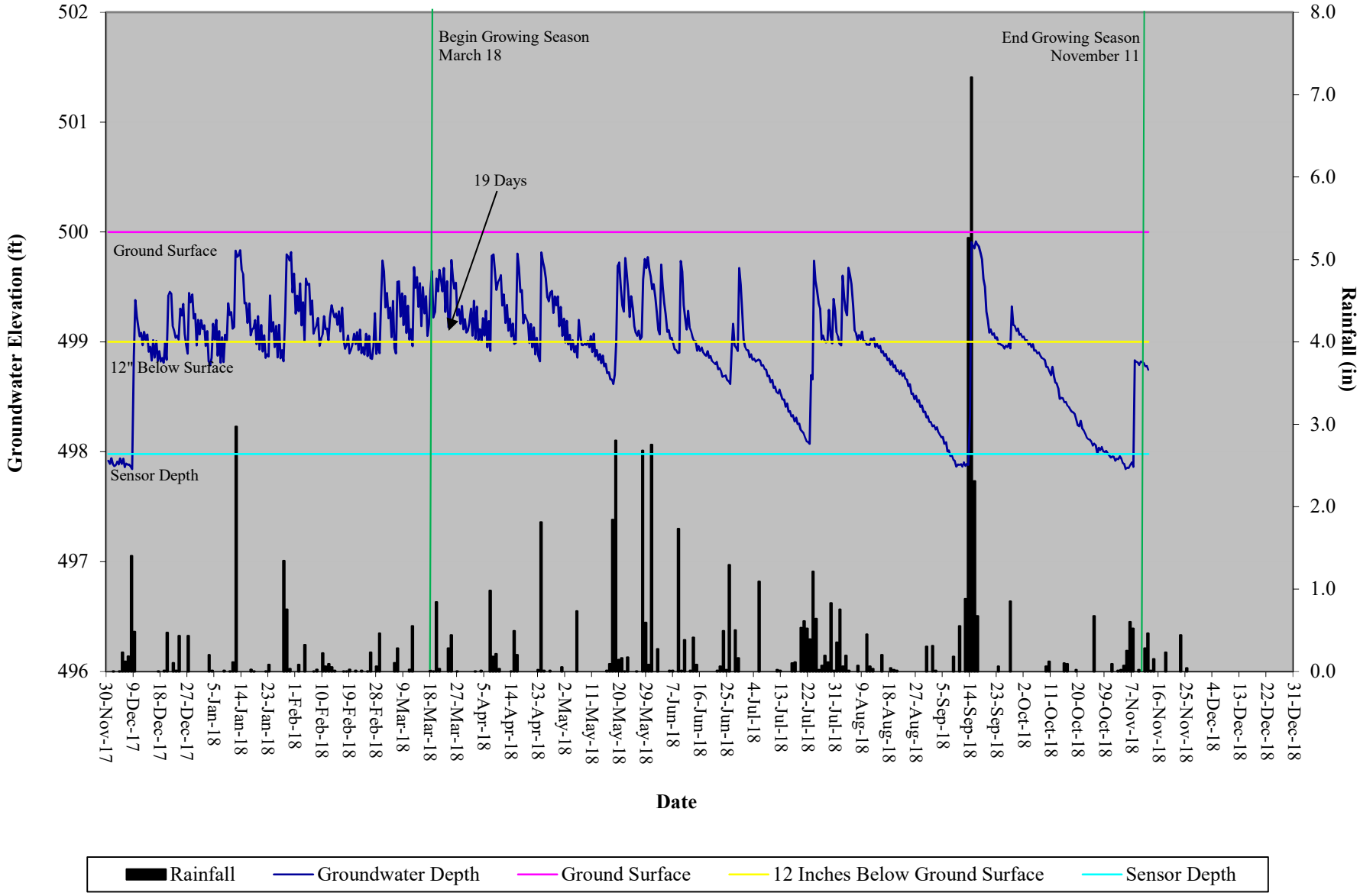
Appendix D

Hydrologic Data

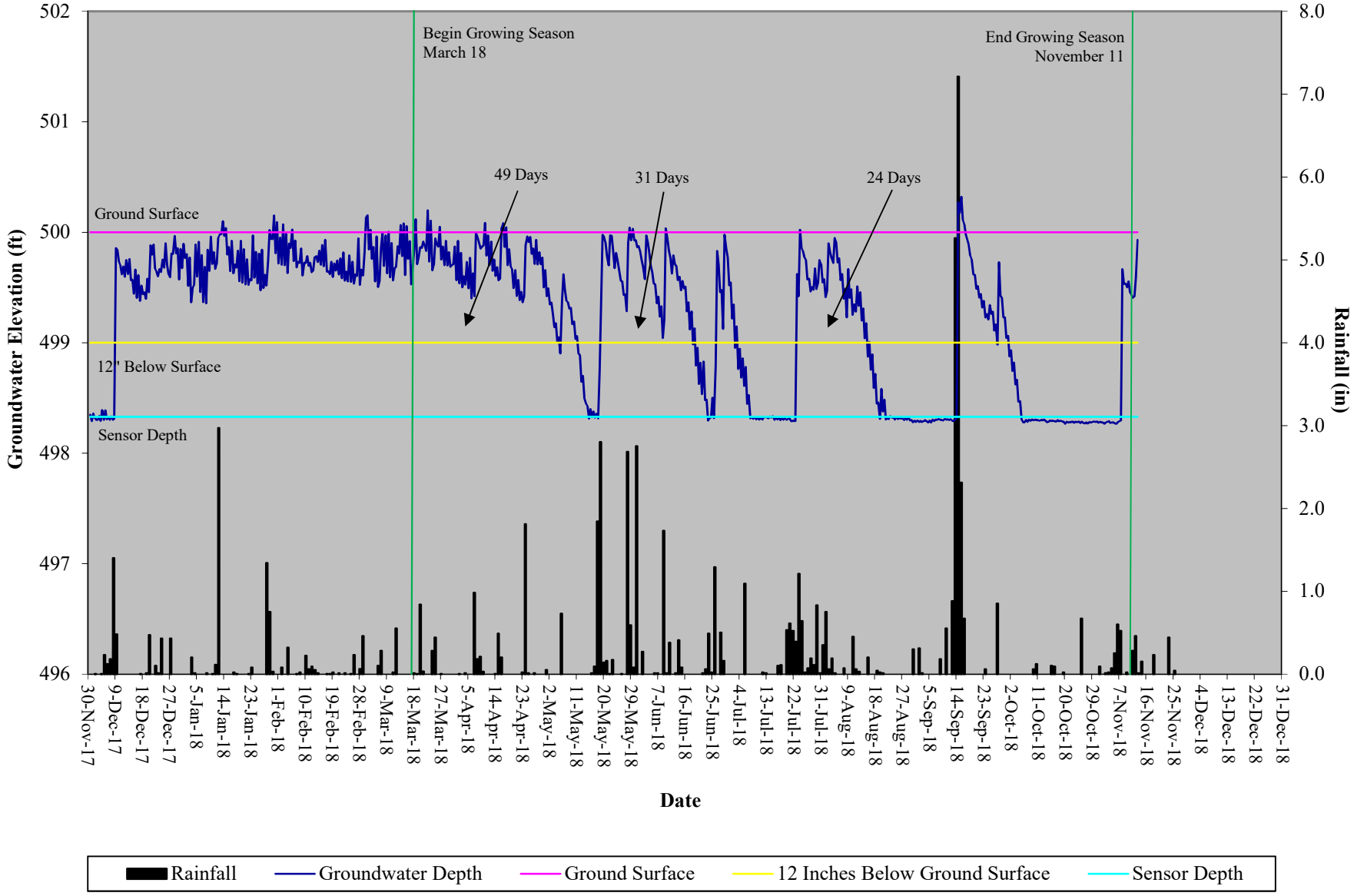
Twin Bays Wetland Restoration Site
30-70 Percentile Graph
WETS Station Name: Warsaw, NC



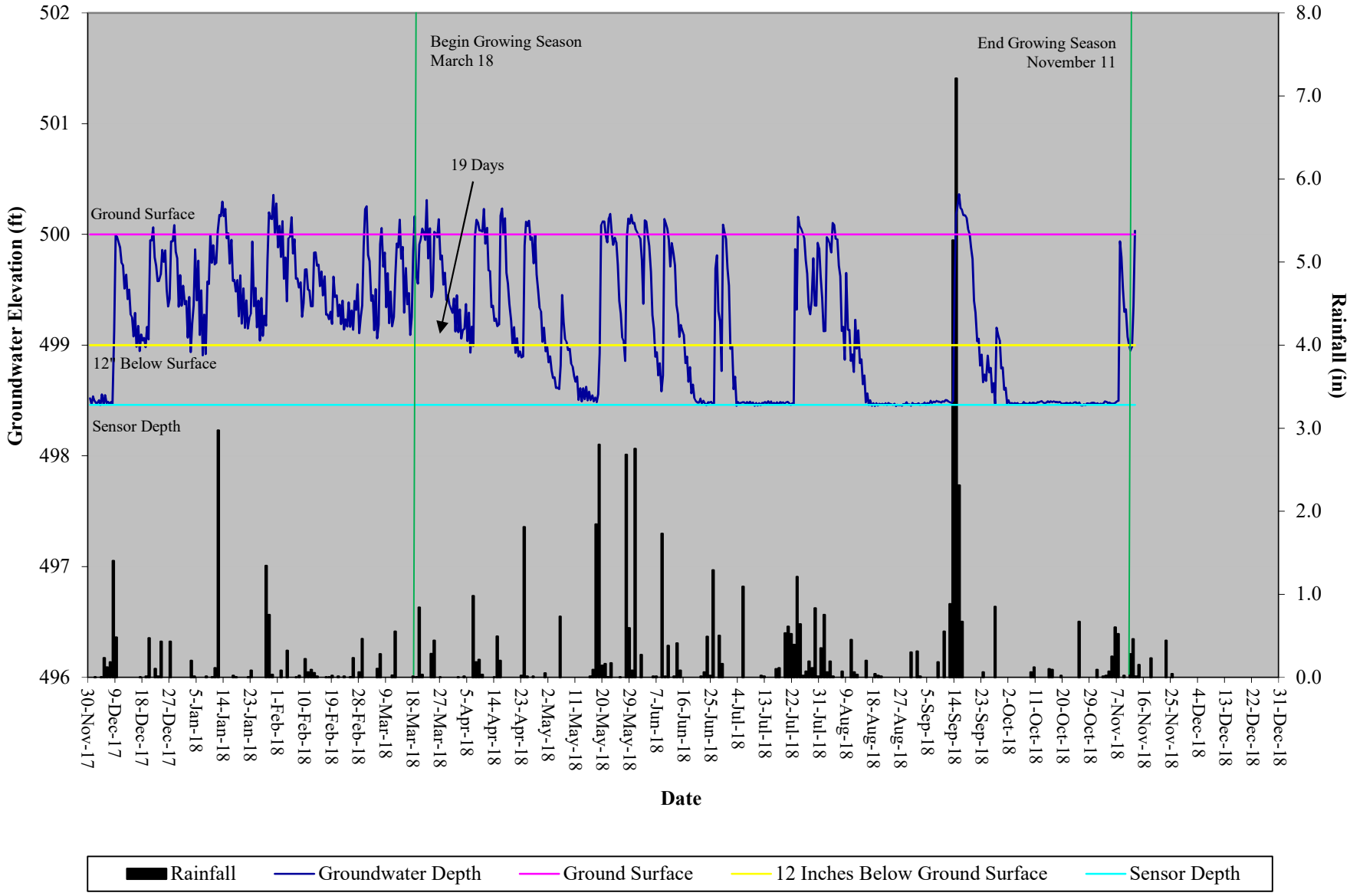
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 1



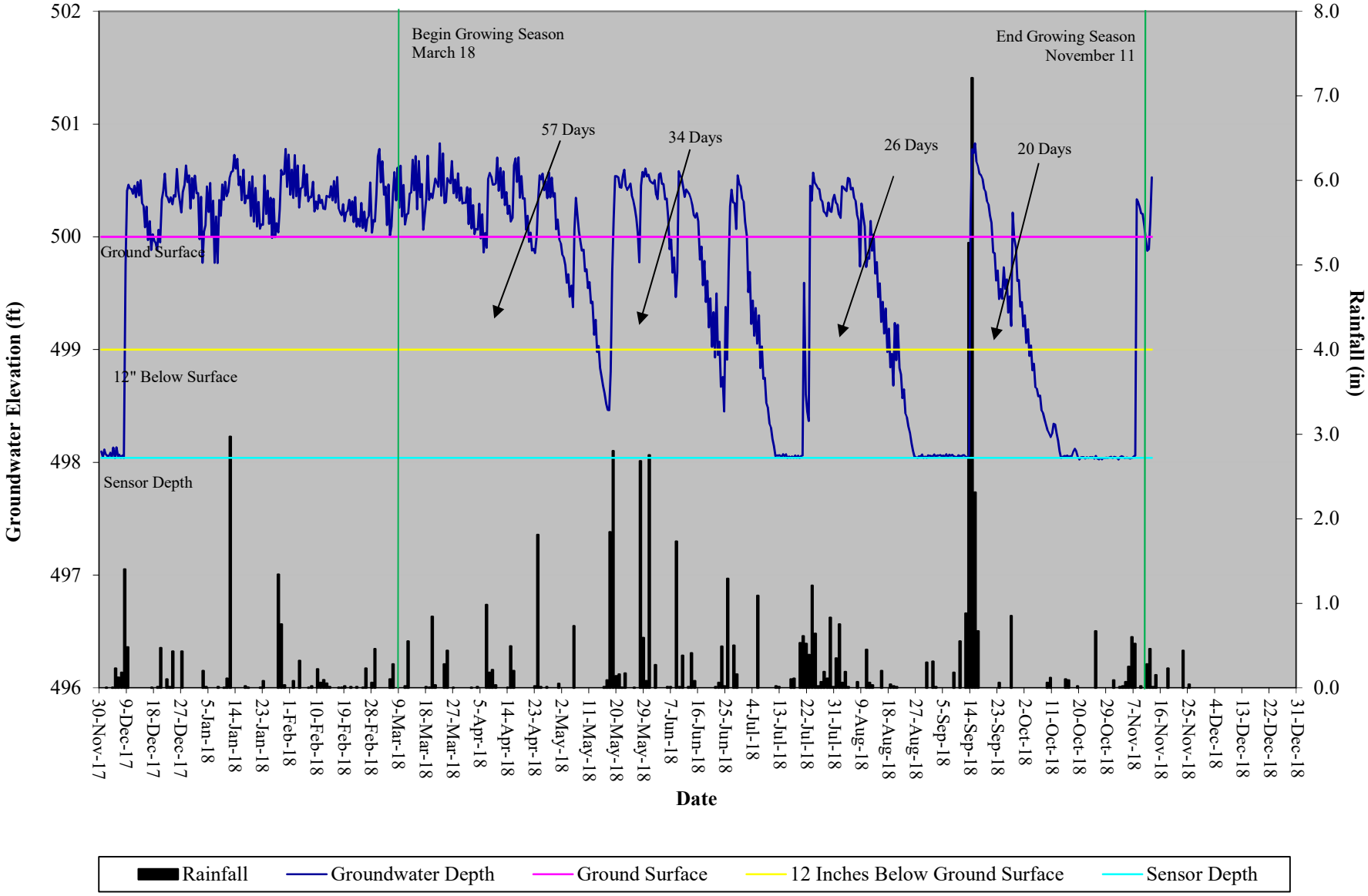
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 2



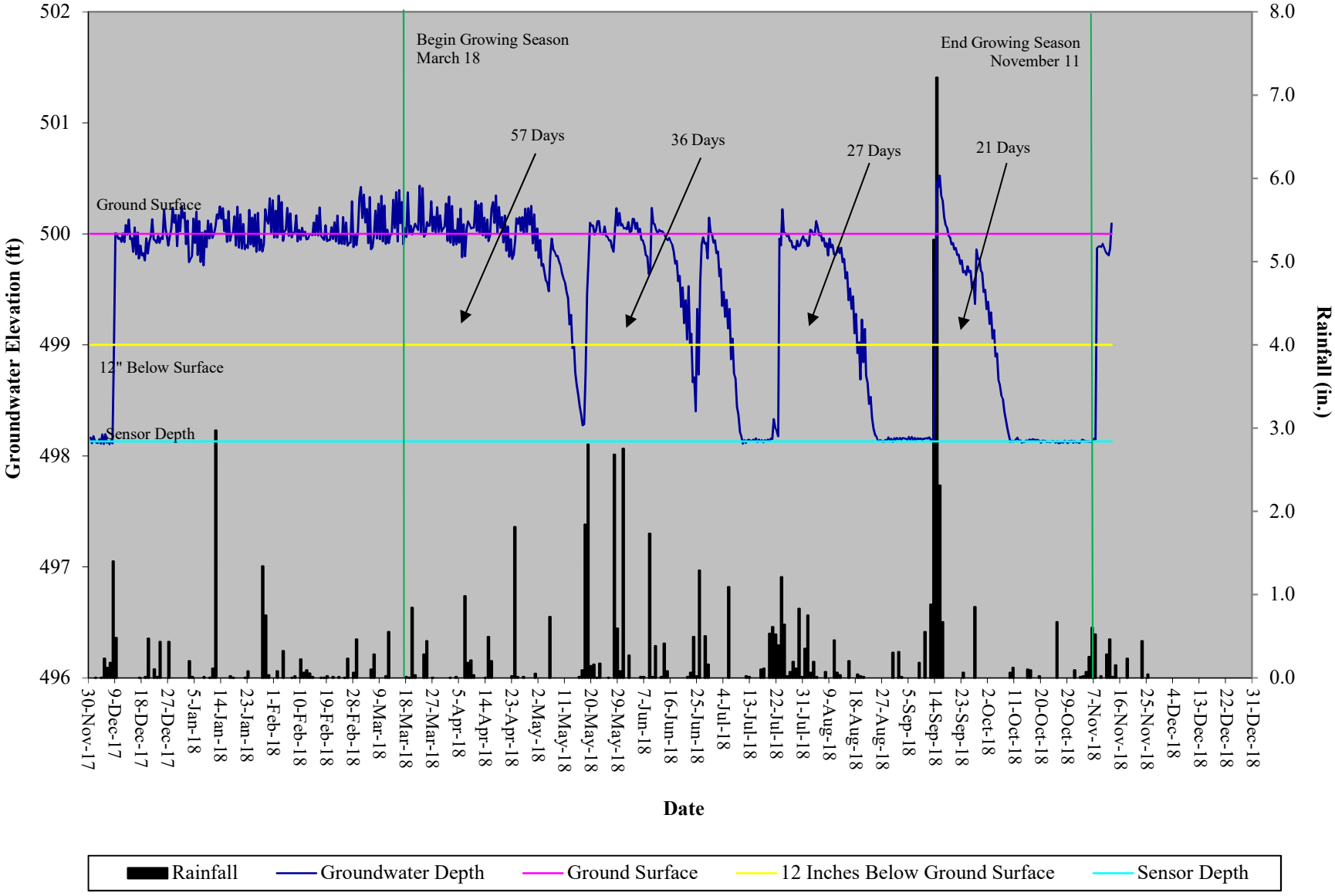
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 3 - non-credit bearing



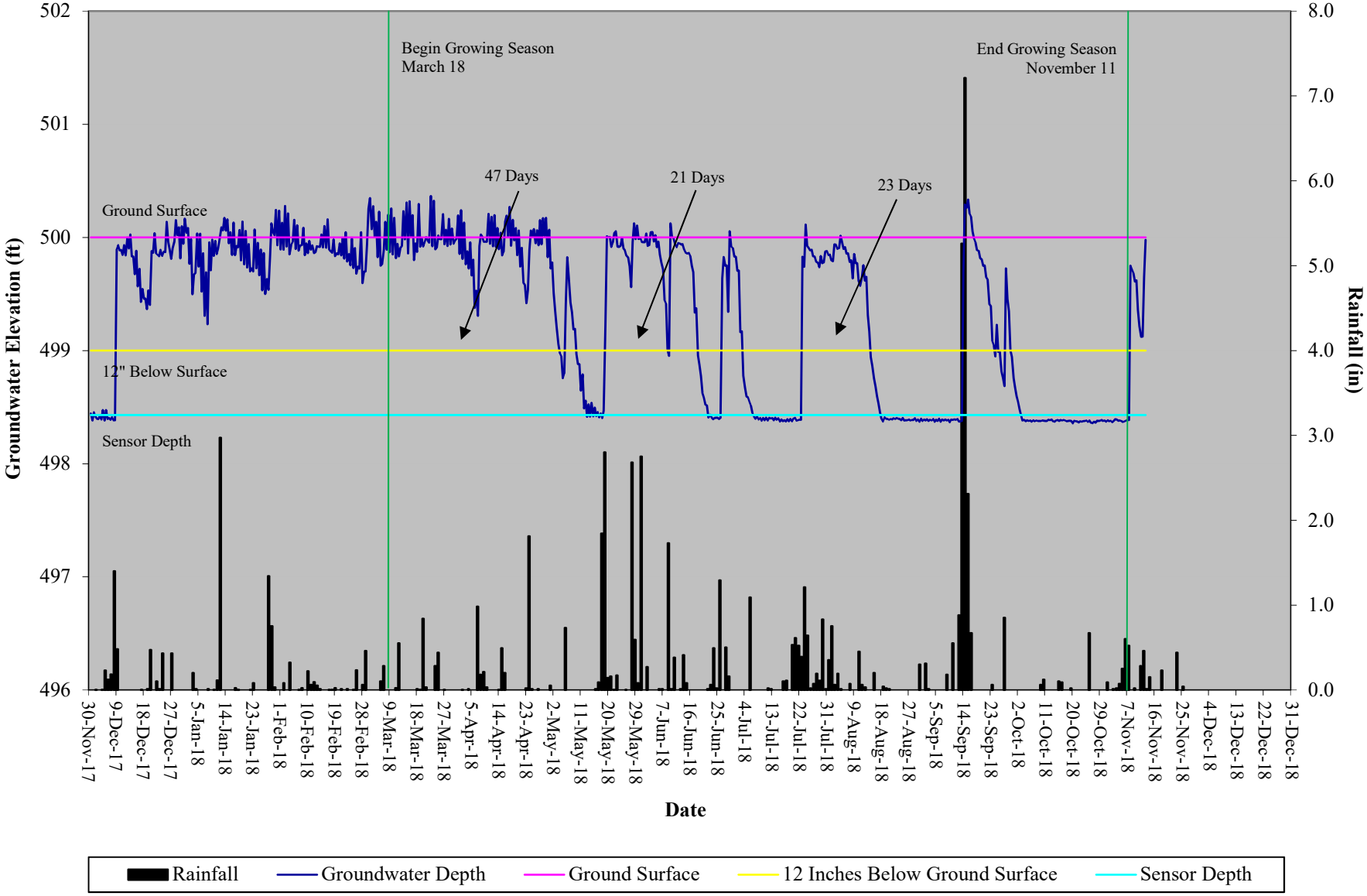
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 4



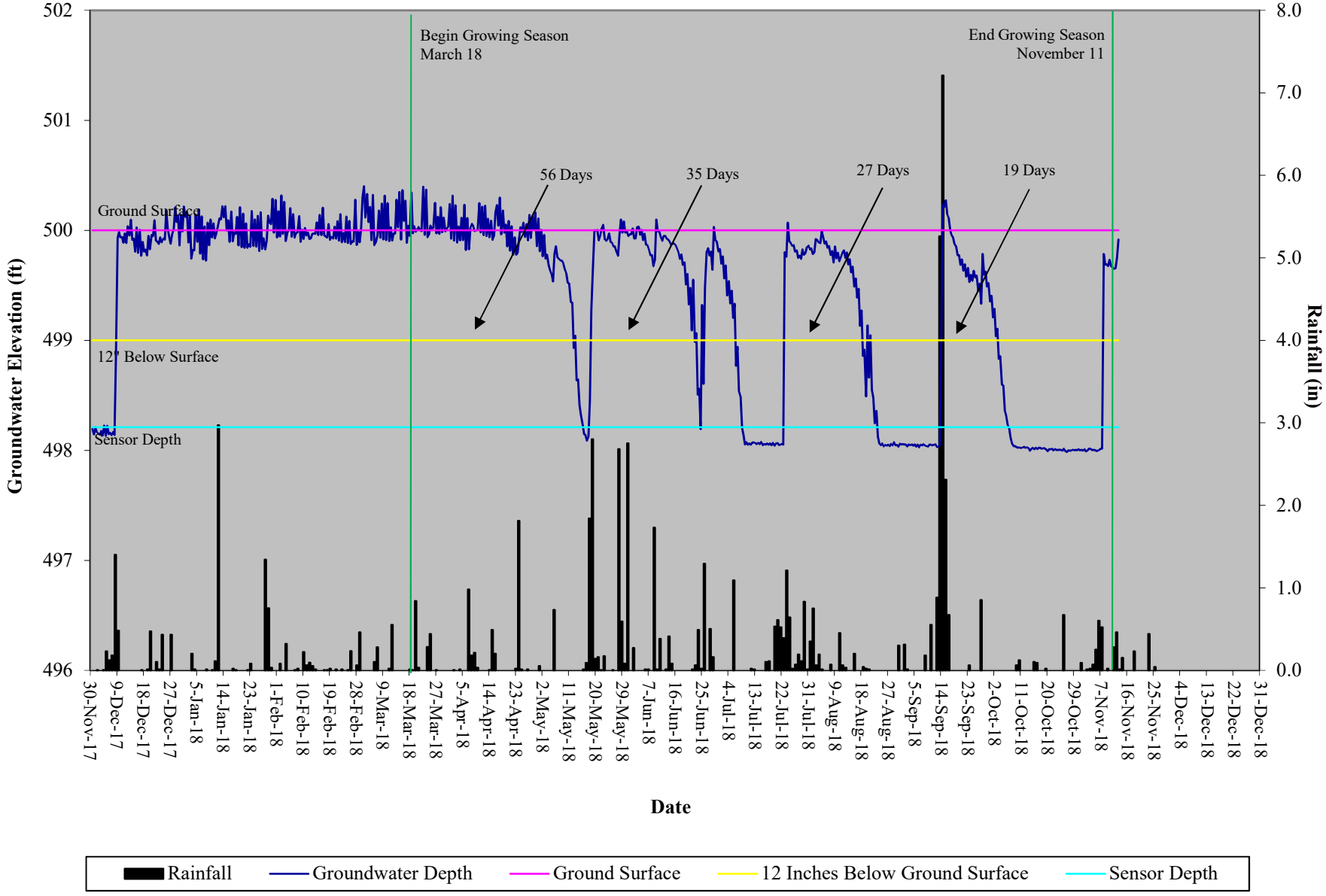
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 5



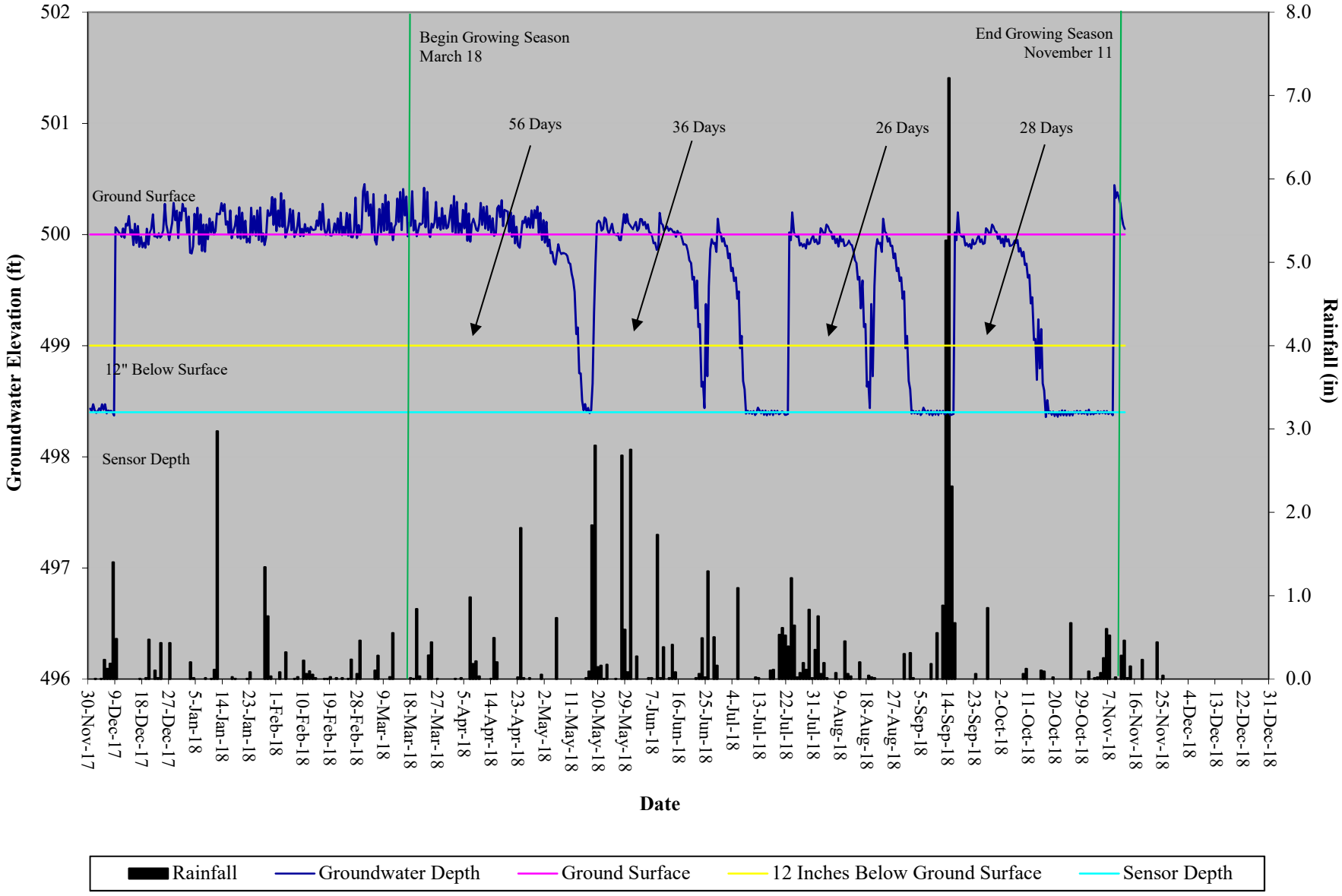
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 6 - non-credit bearing



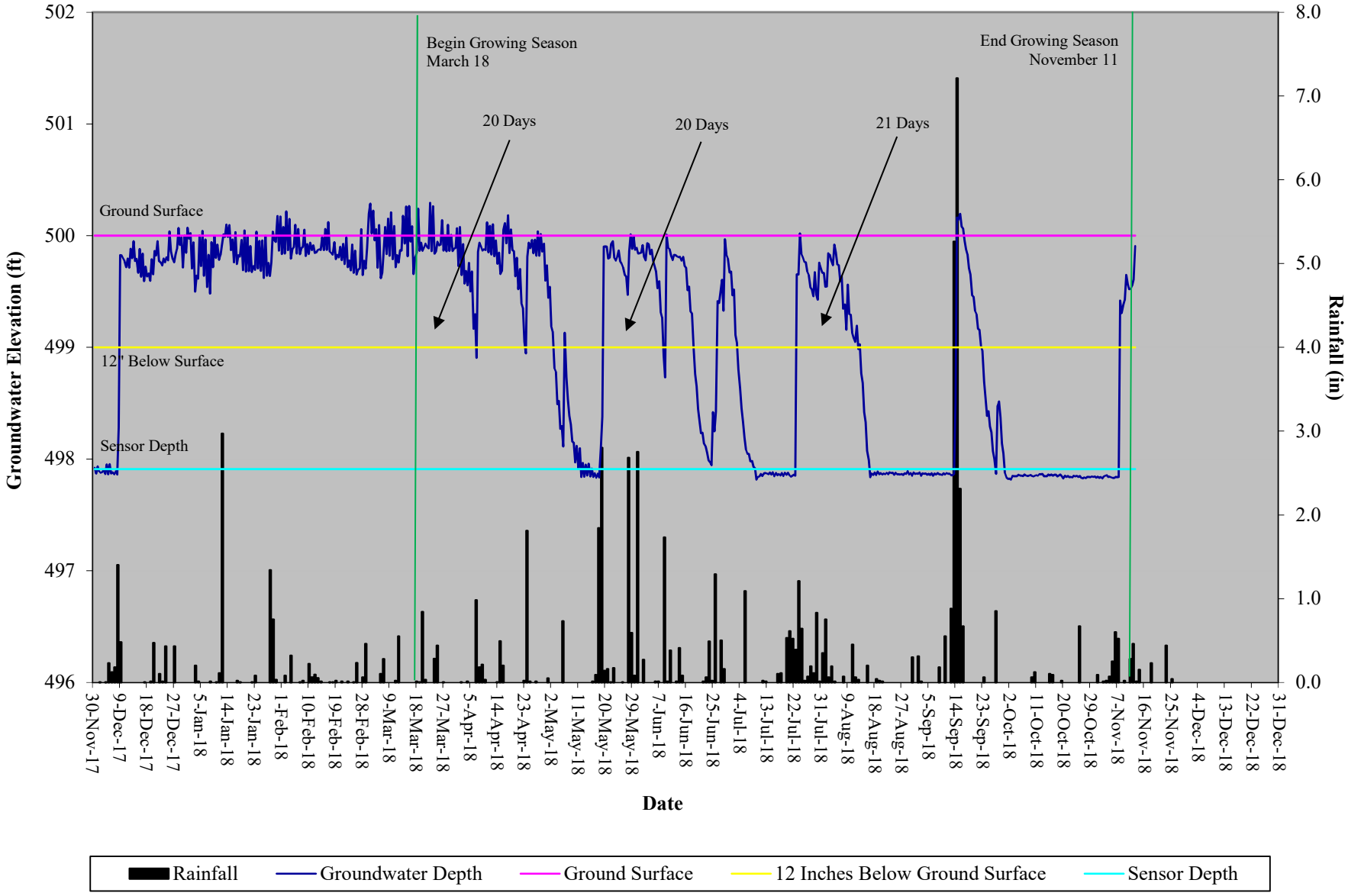
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 7



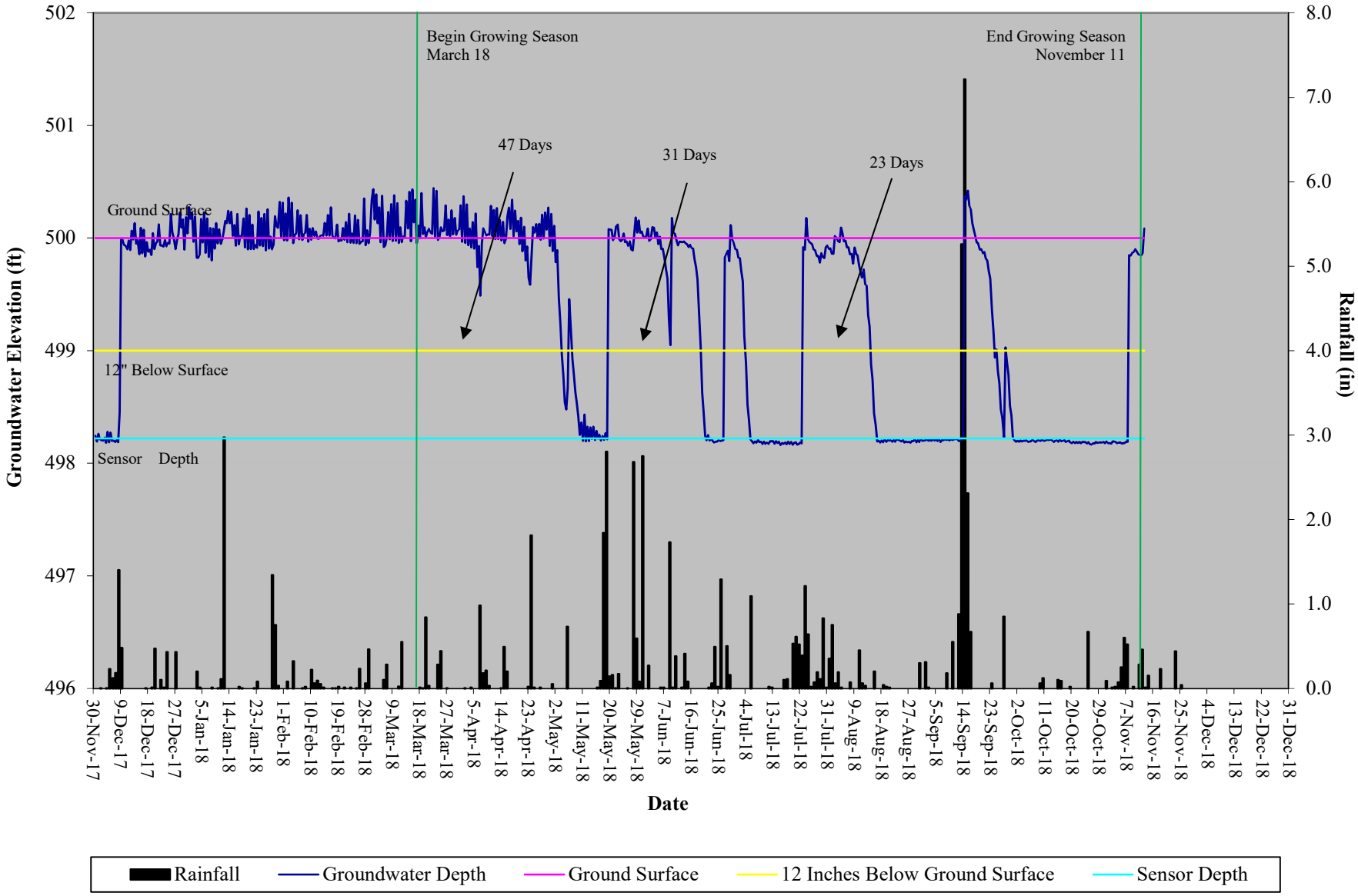
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 8



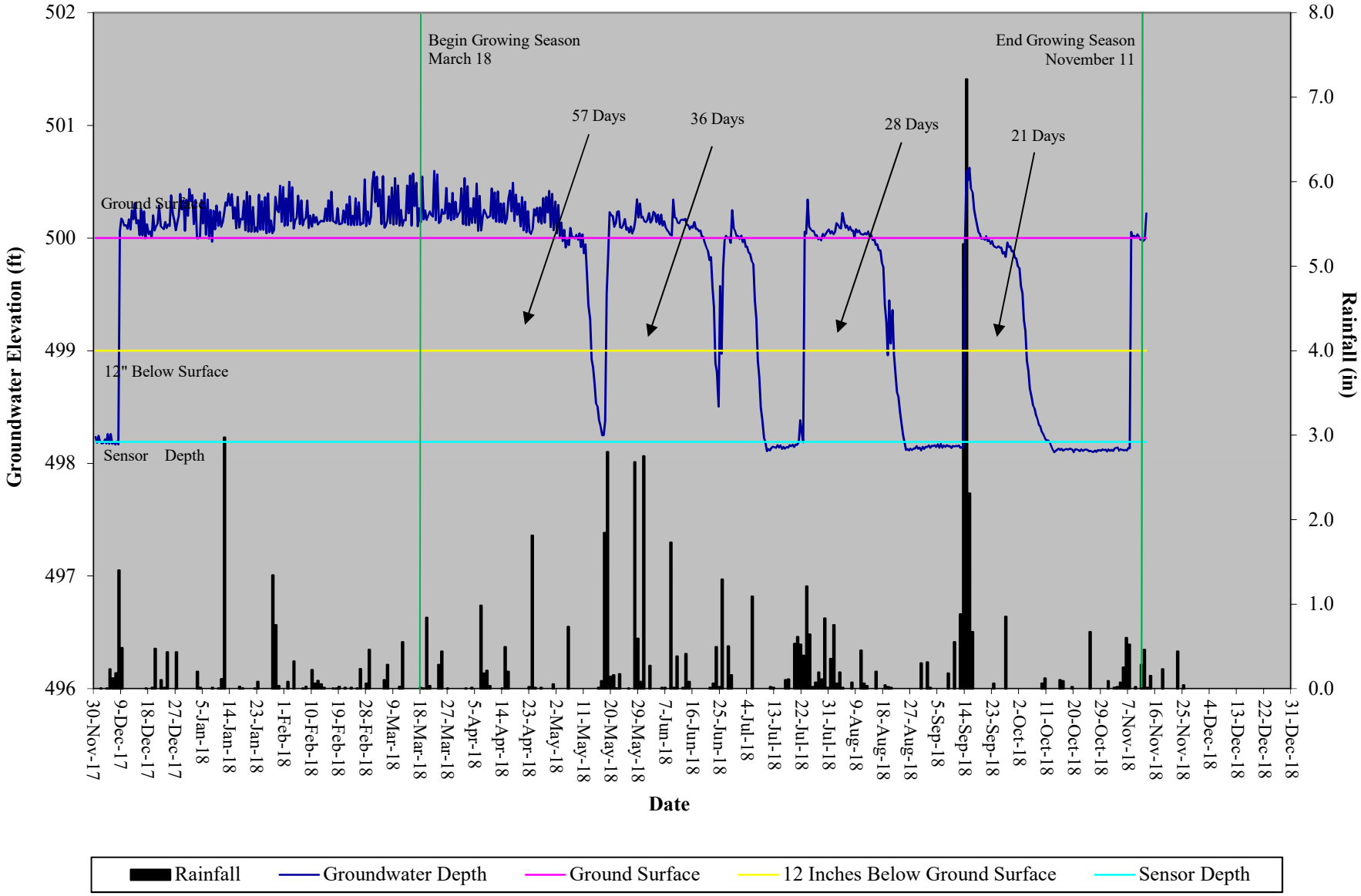
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 9



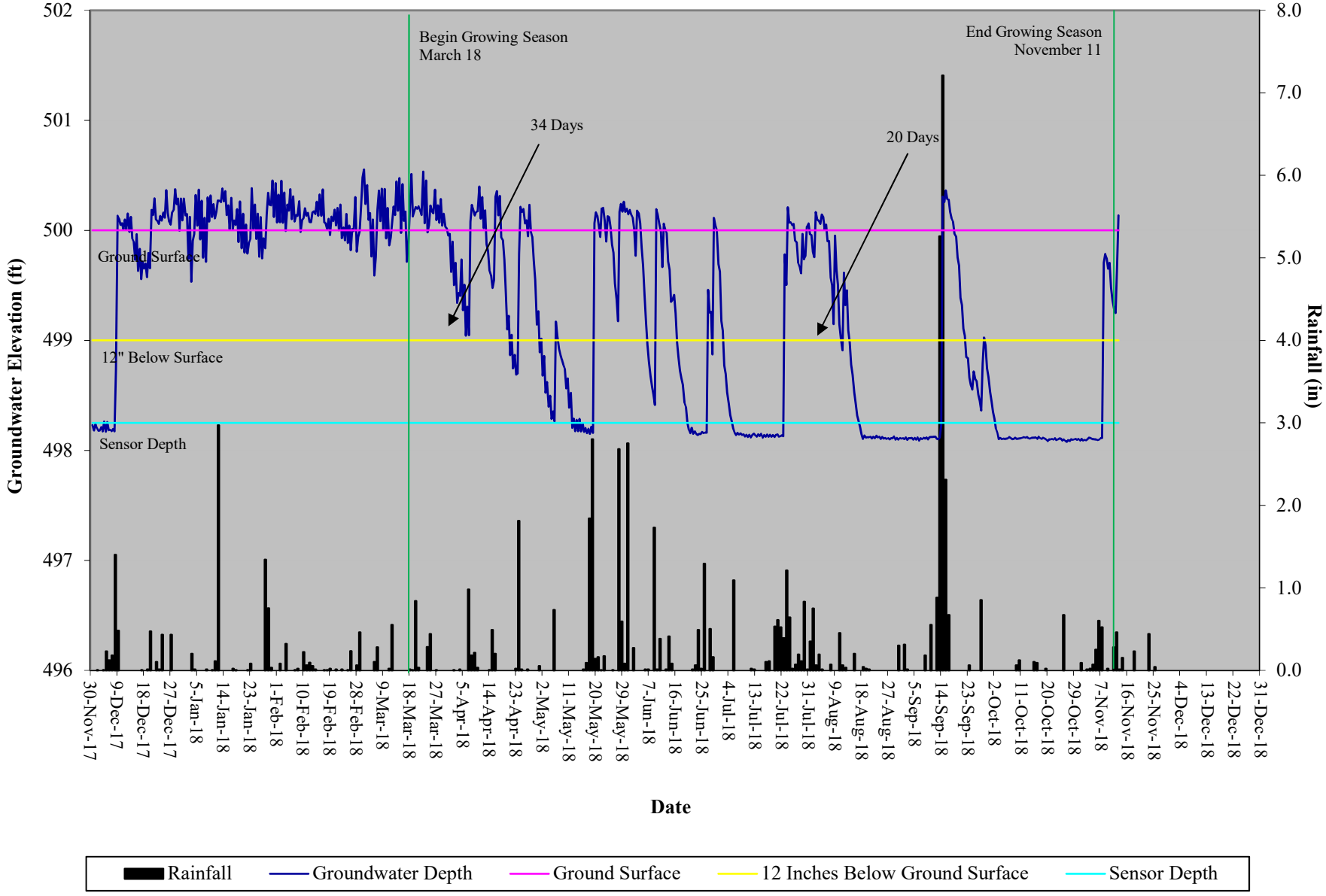
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 10



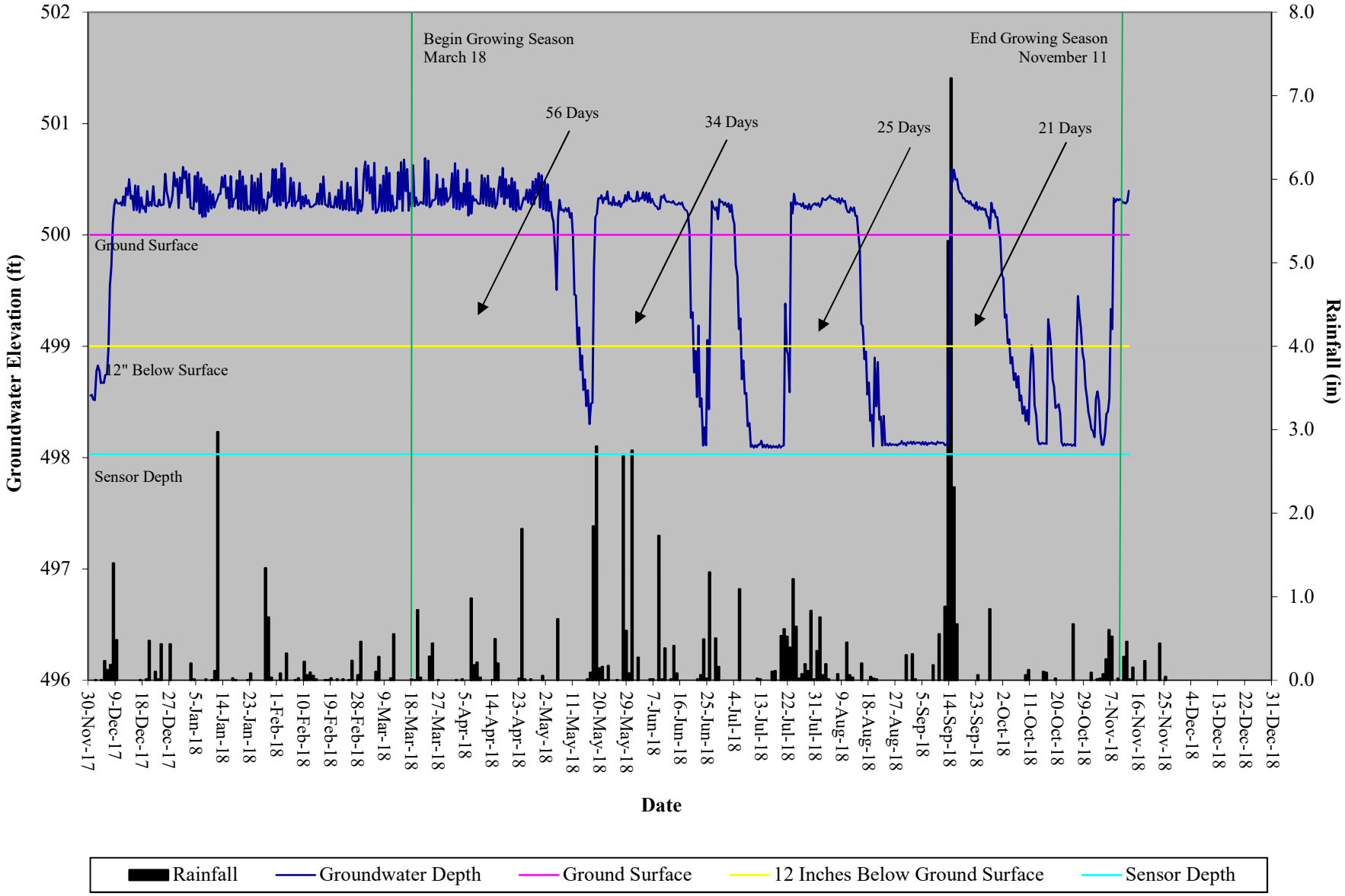
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 11



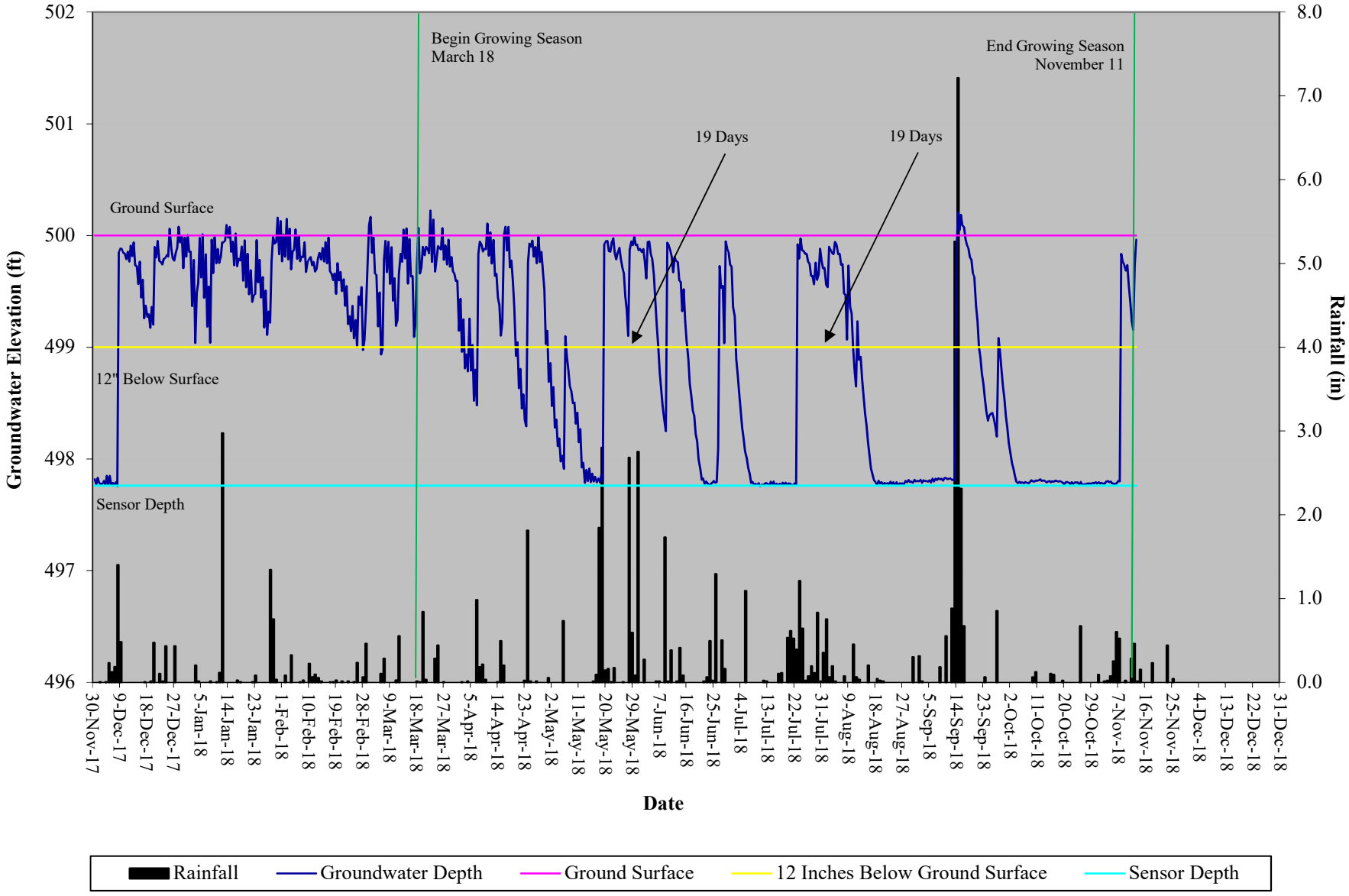
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 12



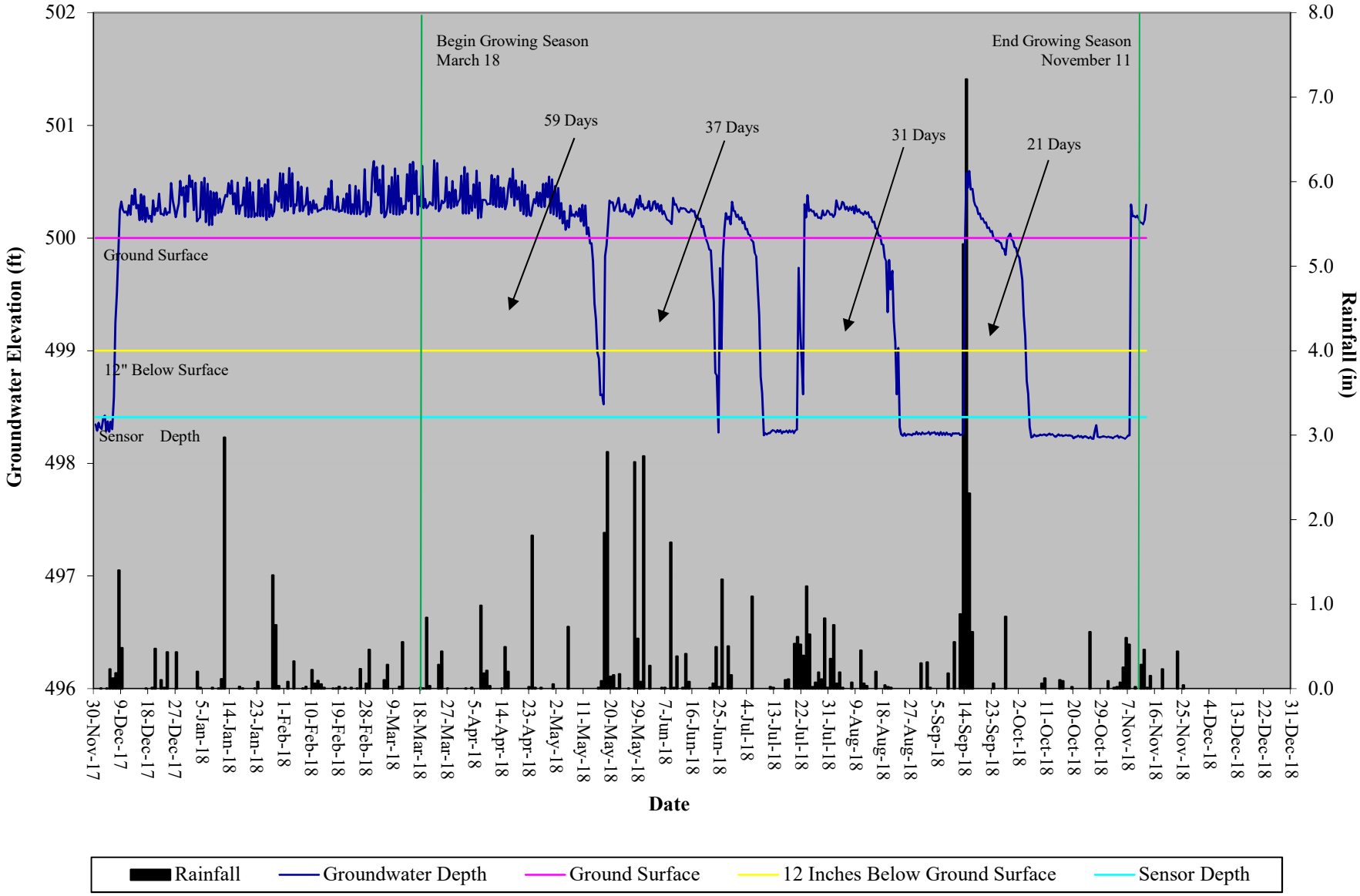
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 13



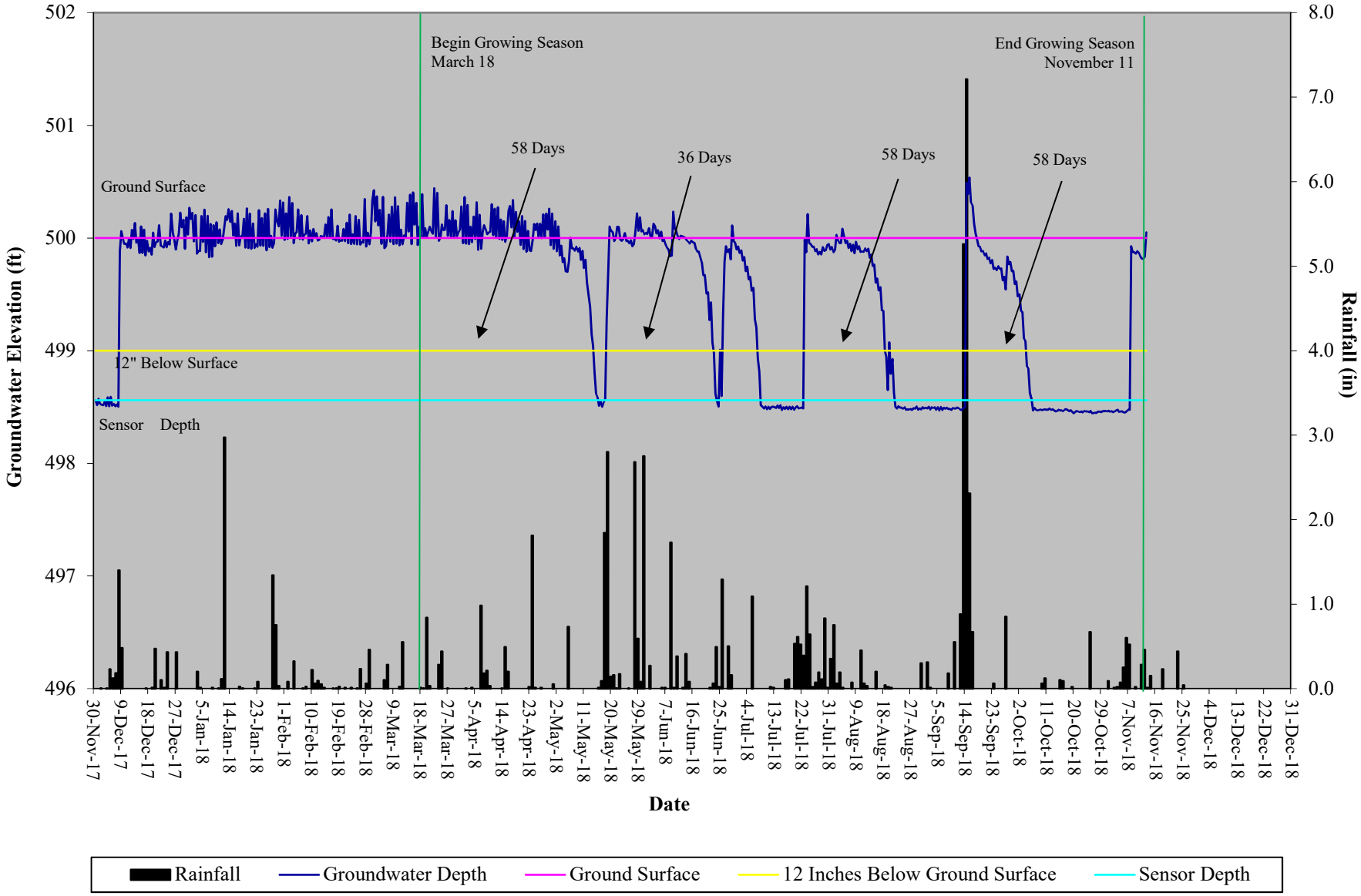
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 14



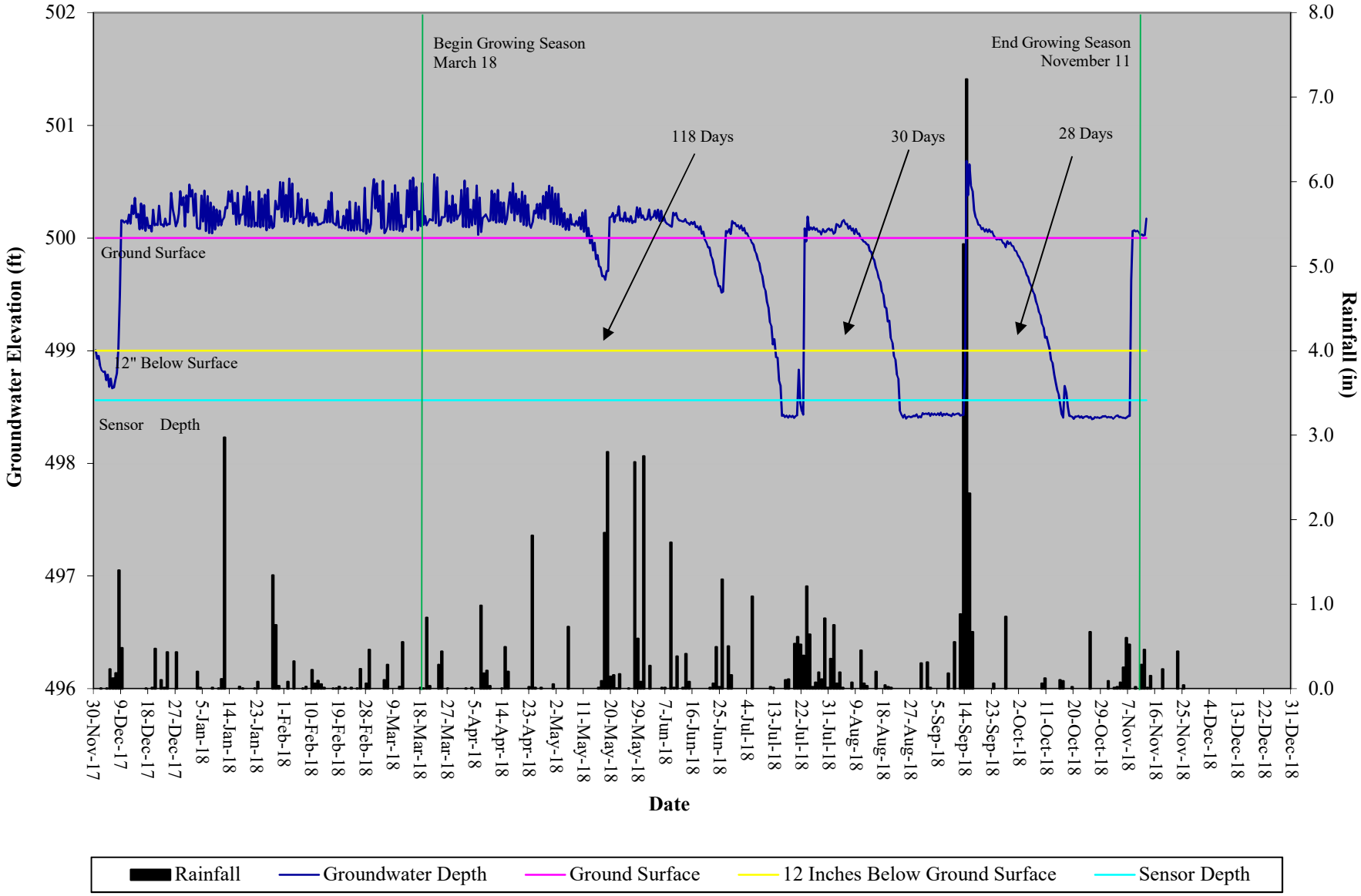
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 15



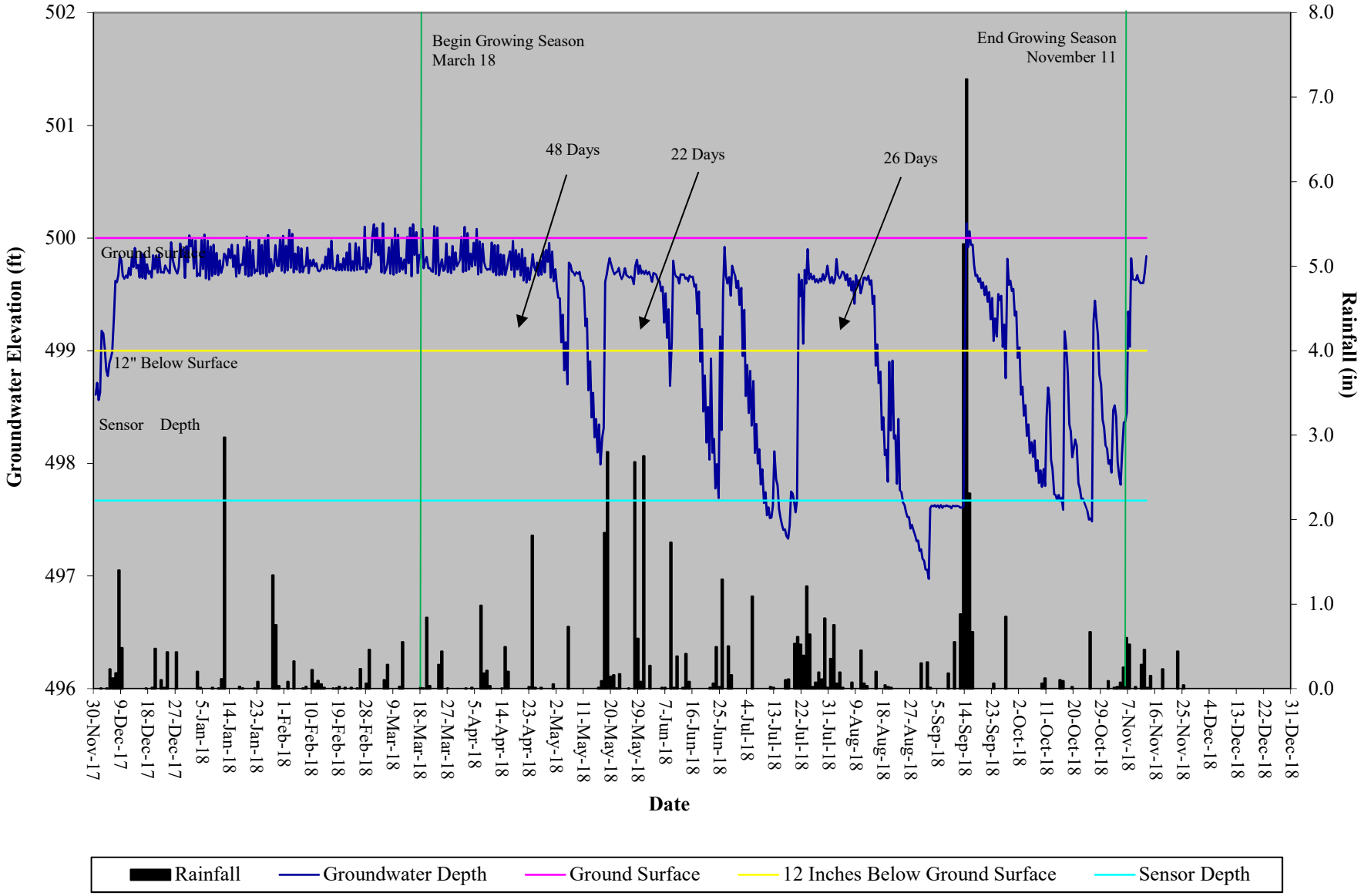
Twin Bays Restoration Site
Hydrograph
Wetland Gauge 16



Twin Bays Restoration Site
Hydrograph
Wetland Gauge 17



Twin Bays Restoration Site
Hydrograph
Wetland Gauge 18



Twin Bays Restoration Site
Hydrograph
Wetland Gauge 19

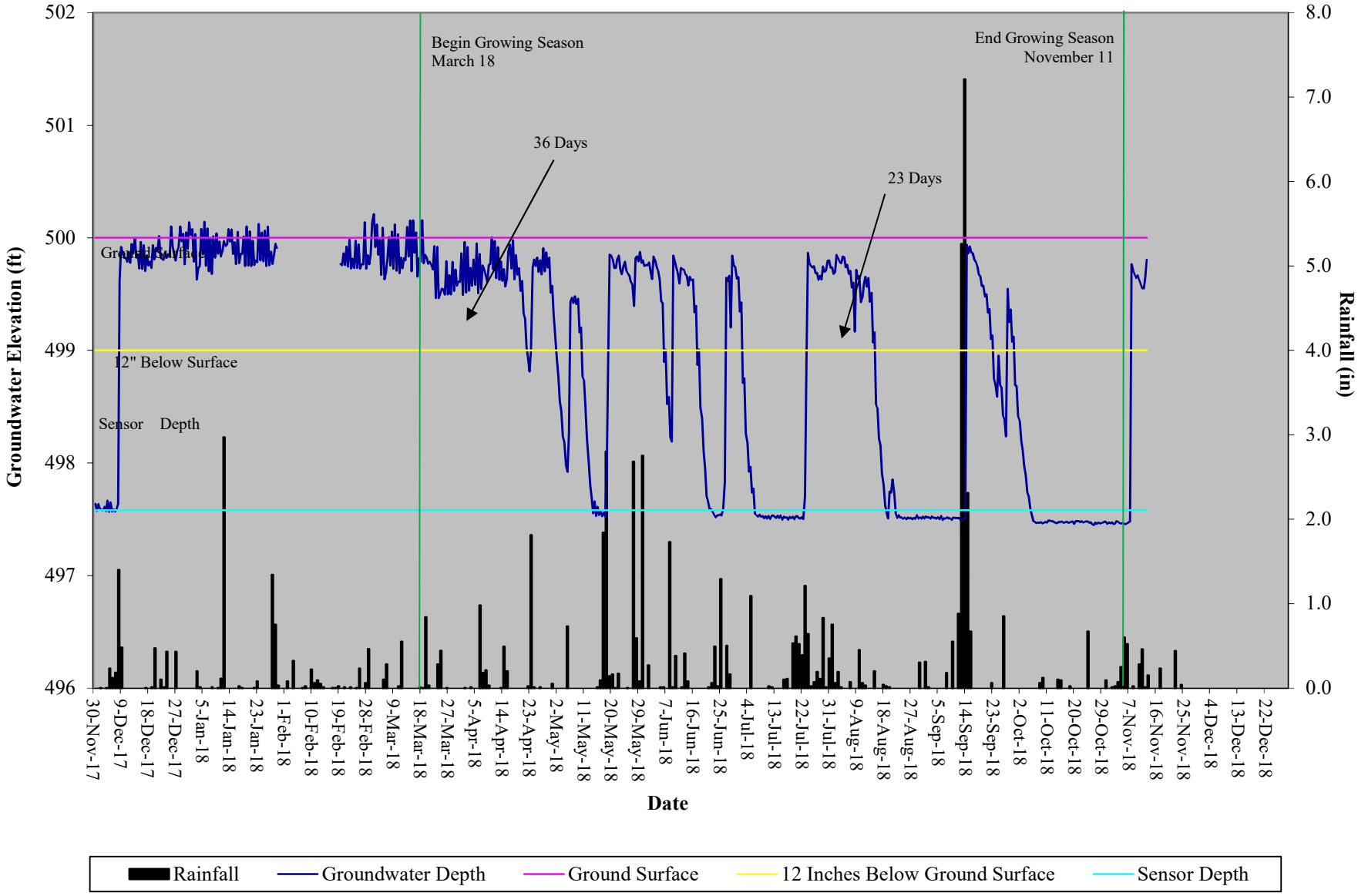


Table 9. Wetland Hydrology Attainment Table Twin Bays Restoration Site, DMS Project #95363							
	Greater than 8% Continuous Saturation/Max Consecutive Days During Growing Season (Percentage)						
Gauge #	**MY-01 2014**	**MY-02 2015**	**MY-03 2016**	**MY-04 2017**	**MY-05 2018**	**MY-06 2019**	**MY-07 2020**
Gauge 1	Yes/25 (10.5%)	Yes/105 (43.9%)	No‡/2 (0.8%)	No/9 (3.8%)	Yes/19 (8.0%)		
Gauge 2	No/16 (6.5%)	Yes/75 (31.4%)	Yes/36 (14.9%)	Yes/30 (12.6%)	Yes/49 (20.3%)		
Gauge 3*	13 (5.2%)	18 (7.3%)	10 (4.0%)	14 (5.9%)	19 (8.0%)		
Gauge 4	Yes/26 (10.9%)	Yes/92 (38.5%)	Yes/36 (15.1%)	Yes/56 (23.4%)	Yes/57 (23.6%)		
Gauge 5	Yes/27 (11.1%)	Yes/98 (41.0%)	Yes/53 (22.2%)	Yes/53 (22.2%)	Yes/57 (23.6%)		
Gauge 6*	13 (5.4%)	41 (17.2%)	28 (11.5%)	26 (10.9%)	47 (19.7%)		
Gauge 7	Yes/27 (11.1%)	Yes/75 (31.4%)	Yes/36 (14.9%)	Yes/51 (21.3%)	Yes/56 (23.2%)		
Gauge 8	Yes/24 10.0%	Yes/75 (31.4%)	Yes/89 (37.0%)	Yes/37 (15.5%)	Yes/56 (23.2%)		
Gauge 9	No/17 (6.9%)	Yes/92 (38.3%)	Yes/27 (11.1%)	Yes/24 (10.0%)	Yes/21 (8.6%)		
Gauge 10	Yes/24 (9.8%)	Yes/22 (9.2%)	Yes/49 (20.5%)	Yes/26 (10.9%)	Yes/47 (19.7%)		
Gauge 11	Yes/28 (11.7%)	Yes/100 (41.8%)	Yes/92 (38.5%	Yes/58 (24.3%)	Yes/57 (23.6%)		
Gauge 12	No/14 (5.9%)	Yes/103 (43.1%)	No/18 (7.3%)	Yes/26 (10.9%)	Yes/34 (14.2%)		
Gauge 13	No/15 (6.1%)	Yes/74 (30.8%)	Yes/54 (22.6%)	Yes/41 (17.2%)	Yes/56 (23.2%)		
Gauge 14	Yes/22 (9.0%)	Yes/19 (8.0%)	No/13 (5.2%)	Yes/24 (10.0%)	Yes/19 (8.0%)		
Gauge 15	Yes/27 (11.1%)	Yes/76 (31.8%)	Yes/95 (39.7%	Yes/60 (25.1%)	Yes/59 (24.5%)		
Gauge 16	Yes/49 20.3%	Yes/76 (31.8%)	Yes/59 (24.5%)	Yes/58 (24.3%)	Yes/58 (24.1%)		
Gauge 17**	-	Yes/104 (43.5%)	Yes/103 (42.9%)	Yes/73 (30.5%)	Yes/118 (49.2%)		
Gauge 18†	-	-	-	Yes/58 (24.3%)	Yes/48 (19.9%)		
Gauge 19†	-	-	-	No/15 (6.3%)	Yes/36 (14.9%)		

* = Gauge in the non-credit bearing zone
** = Gauge installed 3/8/2015
† = Gauge installed 4/6/2017
‡=Gauge malfunctioned