YEAR 5 (2011)
ANNUAL MONITORING REPORT
ANDERSON SWAMP WETLAND RESTORATION SITE
EDGECOMBE COUNTY, NORTH CAROLINA

(CONTRACT D06048)
FULL DELIVERY PROJECT
TAR-PAMLICO RIVER BASIN
CATALOGING UNIT 03020102

Prepared for:

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
RALEIGH, NORTH CAROLINA

Prepared by:

Restoration Systems, LLC
1101 Haynes Street, Suite 211
Raleigh, North Carolina 27604

And

Axiom Environmental, Inc.
218 Snow Avenue
Raleigh, North Carolina 27603

November 2011

EXECUTIVE SUMMARY

Restoration Systems has completed restoration of nonriverine wetlands at the Anderson Swamp Wetland Restoration Site to assist the North Carolina Ecosystem Enhancement Program in fulfilling restoration goals in the region. The Site is located approximately 6 miles north of Tarboro, in northern Edgecombe County. The Site encompasses approximately 25 acres of land that was used for agricultural row crop production and land application of hog lagoon effluent prior to Site restoration. The project provides 21.3 acres of restored or enhanced nonriverine forested wetlands and 3.7 acres of nonriverine upland flats, with benefits to water quality and wildlife in a watershed that is highly dissected for agriculture and timber production.

Primary activities at the Site were designed to restore agricultural fields that had been ditched, drained, and cleared for row crop production. Prior to implementation, the 25-acre Site was characterized by row crops and was underlain by approximately 12.9 acres of hydric soil that had been effectively drained and 8.4 acres of hydric soil with jurisdictional wetland hydrology. Restoration activities included (1) ditch cleaning prior to backfill, (2) ditch rerouting, (3) depression construction, (4) impervious ditch plug construction, (5) ditch backfilling, (6) wetland soil surface scarification, and (7) plant community restoration.

As constructed, the 25-acre Site provides 12.9 acres of nonriverine wetland restoration, 8.4 acres of nonriverine wetland enhancement, and 3.7 acres of forested upland buffer for a total of 17.1 Nonriverine Wetland Mitigation Units.

Nine vegetation plots (10-meters by 10-meters in size) were surveyed in July 2011 for the Year 5 (2011) monitoring season. Based on the number of stems counted, average densities were measured at 643 planted stems per acre surviving in Year 5 (2011). The dominant species identified at the Site were planted stems of cherrybark oak (*Quercus pagoda*), willow oak (*Quercus phellos*), swamp chestnut oak (*Quercus michauxii*), and water oak (*Quercus nigra*). No vegetation problem areas were noted during the Year 5 (2011) monitoring season.

Wetlands at the Site are developing well despite continued drought conditions with the development of hydrophytic herbaceous vegetation and hydric soil characteristics. Based on recent field visits, gauge data, rain data, and jurisdictional wetland delineations, wetlands at the Site should be considered successful.

Three gauges (Gauges 1, 3, and 4) have consistently met success criteria being inundated or saturated for greater than 5 percent of the growing season despite drought conditions during all five monitoring years. Gauge 3 was not functioning properly at the beginning of the Year 5 (2011) growing season and data was unreliable; therefore, the gauge was replaced on May 17, 2011. Based on data from Years 1-4 and visual observations during field visits it is highly likely that this gauge would have met success criteria.

Gauge 2 has fallen below success criteria each year; however, it is located adjacent to the eastern Site boundary, which forms an upland/wetland transition due to groundwater drawdown from a large canal off-site. It appears that as a result of the extended drought the canal may be having an effect on this gauge. Therefore, an additional gauge (Gauge 2.5) was installed approximately 25 feet further into the Site. Gauge 2.5 met success criteria this year with 13.6 percent inundation/saturation. It is anticipated that once rainfall returns to more normal levels for a consistent period of time that Gauge 2 will remain inundated/saturated for an extended period of time.

Gauge 5 is located on an upland/wetland margin and is consistently just below success criteria; however, this gauge has exhibited characteristics almost identical to the reference gauges in all five monitoring years. Due to less than normal rainfall throughout the 5-year monitoring period, this gauge should be compared to reference gauges for success and should be considered successful.

In summary, the restoration site should be considered successful throughout the entire 5-year monitoring period.

TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

1.0 PROJECT BACKGROUND

1.1 Location and Setting

Restoration Systems, L.L.C. (Restoration Systems) has completed restoration of nonriverine wetlands at the Anderson Swamp Wetland Restoration Site (hereafter referred to as the "Site") to assist the North Carolina Ecosystem Enhancement Program (EEP) in fulfilling wetland mitigation goals in the region. The Site, located approximately 6 miles north of Tarboro in northern Edgecombe County, will provide 17.1 nonriverine wetland mitigation units (Figure 1). The Site is located in United States Geological Survey (USGS) Catologing Unit (CU) 03020102060010 (North Carolina Division of Water Quality [NCDWQ] Subbasin 03-03-04) of the Tar Pamlico River Basin and will service the USGS 8-digit CU 03020102.

Directions to the Site from Tarboro, North Carolina, are as follows:

- Travel north on NC Route 44 for approximately 5 miles
- At Leggett, turn right on Draughn Road and travel approximately 4 miles
- Turn right on Bethleham Church Road and travel approximately 1 mile
- The Site is on the right

1.2 Project Objectives

The primary components of the restoration project included 1) ditch cleaning prior to backfill, 2) ditch rerouting, 3) depression construction, 4) impervious ditch plug construction, 5) ditch backfilling, 6) floodplain soil scarification, and 7) plant community restoration.

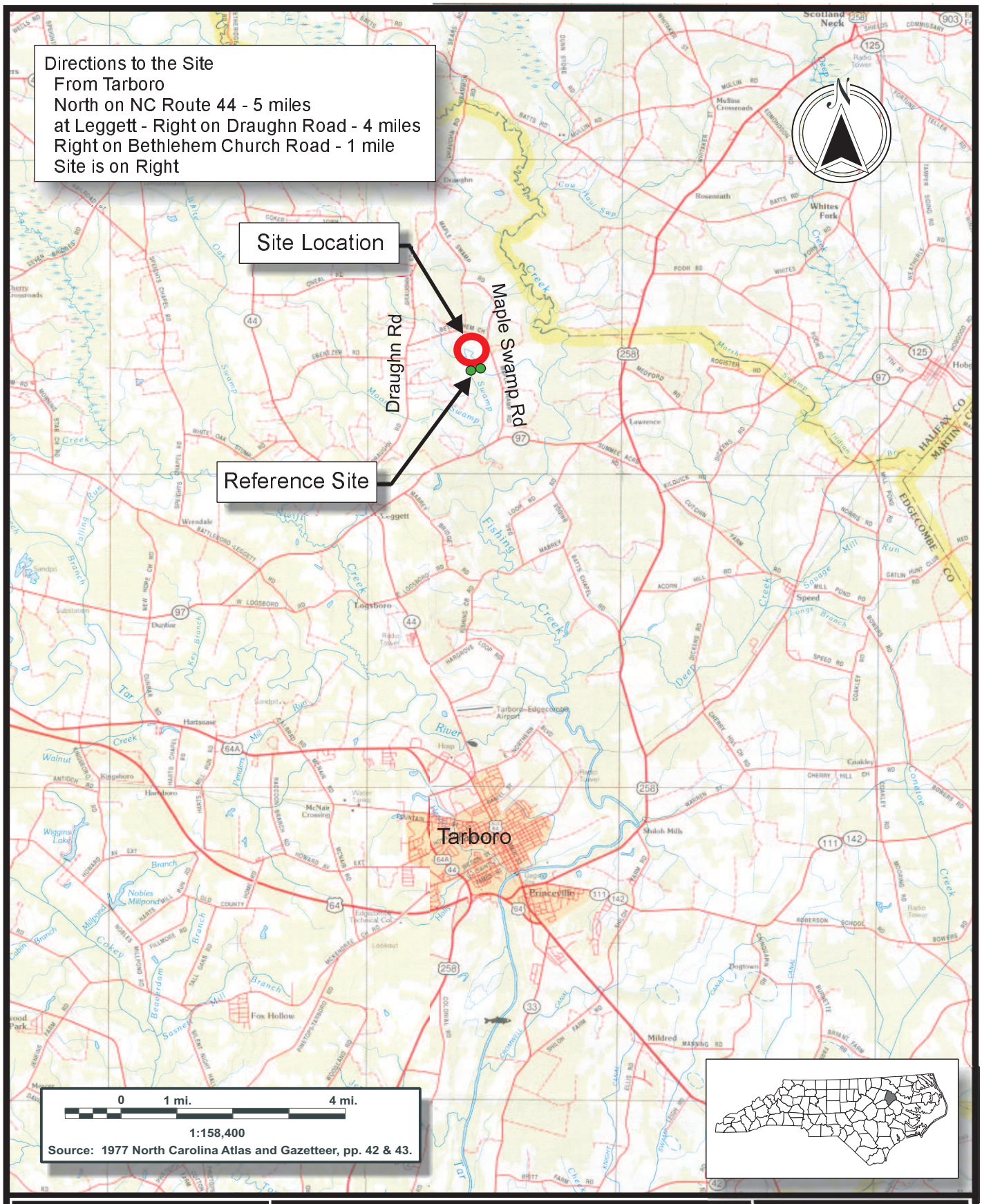
1.3 Project Structure, Restoration Type, and Approach

A conservation easement has been placed on the Site to incorporate all restoration activities. The Site contains 21.3 acres of hydric soils within an interstream flat and an additional 3.7 acres of upland slopes. The purpose of this project was to restore and enhance nonriverine wetlands within the Site, in addition planting the Site with native woody vegetation.

Prior to construction, the entire tract was utilized for agricultural row crop production and land application of hog lagoon effluent. The Site is situated within a terrace on the western rim of the Fishing Creek floodplain between a headwater tributary to Maple Swamp and an Unnamed Tributary (UT) to Fishing Creek. The landowner regularly dredged the channel in preparation for agricultural practices and an extensive ditch system had been excavated to drain the Site. Site agricultural practices contributed to degraded water quality, decreased wetland function, and decreased headwater storage benefits to Maple Swamp and Fishing Creek.

The primary goals of the nonriverine wetland restoration project focused on improving water quality, enhancing flood attenuation, and restoring wildlife habitat and were accomplished by the following.

1. Removing nonpoint sources of pollution associated with agricultural row crop production including a) cessation of broadcasting fertilizer, pesticides, and other agricultural chemicals into and adjacent to Site drainage ditches, b) cessation of land application of area hog lagoon effluent, and c) preemption and treatment of agricultural runoff by providing a vegetative buffer adjacent to headwater streams and wetlands.
2. Restoring wetland hydroperiods that satisfy wetland jurisdictional requirements and approximate the Site's natural range of variation.
3. Promoting floodwater attenuation through removal of interfield ditches and enhancing groundwater storage capacity.



Axiom Environmental
2126 Rowland Pond Dr
Willow Spring, NC 27592
(919) 215-1693
(919) 341-3839 fax

SITE LOCATION
ANDERSON SWAMP RESTORATION SITE
Edgecombe County, North Carolina

Dwn. by:	WGL
Ckd by:	WGL
Date:	April 2007
Project:	06-017

FIGURE 1

4. Restoring and reestablishing natural community structure, habitat diversity, and functional continuity.
5. Enhancing and protecting of the Site's full potential of wetland functions and values in perpetuity.

Primary activities at the Site included 1) wetland restoration, 2) wetland enhancement, 3) soil scarification, and 4) plant community restoration. Table 1 describes the Site restoration structures and objectives, which have provided 17.1 Nonriverine Wetland Mitigation Units by the following.

- Restoring approximately 12.9 acres of wetland through filling agricultural ditches, removal of spoil castings, eliminating row crop production activities, and planting with native forest vegetation.
- Enhancing approximately 8.4 acres of wetland through eliminating row crop production activities and planting with native forest vegetation.
- Reforesting the entire floodplain with native forest species.

Table 1. Site Restoration Structures and Objectives

Restoration Segment/ Reach ID	Station Range	Restoration Type/Approach*	Acreage	Mitigation Ratio	WMUs
Nonriverine Wetlands	--	Restoration	12.9	1:1	12.9
Nonriverine Wetlands	--	Enhancement	8.4	2:1	4.2
Mitigation Unit Summations					
Nonriverine Wetland					
17.1 WMU					

1.4 Project History and Background

Completed project activities, reporting history, completion dates, project contacts, and background information are summarized in Tables 2-4.

Table 2. Project Activity and Reporting History

Activity or Report	Actual Completion or Delivery
Restoration Plan	November 2006
Final Design	February 2007
Construction	March 2007
Planting	March 2007
Mitigation Plan / As-Built	April 2007
Year 1 monitoring	November 2007
Year 2 monitoring	November 2008
Year 3 monitoring	July 2009
Year 4 monitoring	November 2010
Year 5 monitoring	November 2011

Table 3. Project Contacts Table

Full Delivery Provider	Restoration Systems 1101 Haynes Street, Suite 211 Raleigh, North Carolina 27604 George Howard and John Preyer (919) 755-9490
Designer and Years 2-5 (2008-2011) Monitoring Performers	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, North Carolina 27603 W. Grant Lewis (919) 215-1693
Construction Contractor	Anderson Farms 179 NC 97 East Tarboro, NC 27886 Gary Wilkerson and Richard Anderson (252) 823-4730
Planting Contractor	Carolina Silvics 908 Indian Trail Road Edenton, NC 27932 Dwight McKinney (919) 523-4375
Year 1 (2007) Monitoring Performers	ARACDIS G&M of North Carolina, Inc. 801 Corporate Center Drive, Suite 300 Raleigh, NC 27607 Ben Furr and Keven Duerr (919) 854-1282

Table 4. Project Background Table

Project County	Edgecombe County, North Carolina
Physiographic Region	Coastal Plain
Ecoregion	Southeastern Plains
Cowardin Classification	PFO1B
Dominant Soil Types	Roanoke loam, Wickham sandy loam
Reference Site ID	Immediately south of Site
USGS HUC	03020102
NCDWQ Subbasin	03-03-04
NCDWQ Classification	WS-IV NSW
Any portion of any project segment 303d listed?	No
Any portion of project upstream of a 303d listed segment?	No
Reasons for 303d listing or stressor	Not Applicable
% of project easement fenced	0%

1.5 Monitoring Plan View

Monitoring activities for the Site, including relevant structures and utilities, project features, specific project structures, and monitoring features are detailed in the monitoring plan view in Appendix C. Site features including vegetation, wetland hydrology, and photographic documentation were monitored in Year 5 (2011).

2.0 PROJECT CONDITION AND MONITORING RESULTS

2.1 Vegetation Assessment

Nine vegetation plots (10 meters by 10 meters in size) were sampled in July 2011 for Year 5 (2011) monitoring as outlined in the *CVS-EEP Protocol for Recording Vegetation, Version 4.0* (Lee et al. 2006) (http://cvs.bio.unc.edu/methods.htm); results are included in Appendix A. The taxonomic standard for vegetation used for this document was *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas* (Weakley 2007). The locations of vegetation monitoring plots were placed to accurately represent the entire Site and are depicted on the monitoring plan view in Appendix C.

2.1.1 Vegetation Success Criteria

Success criteria have been established to verify that the vegetation component supports community elements necessary for floodplain forest development. Success criteria are dependent upon the density and growth of characteristic forest species. Additional success criteria are dependent upon density and growth of "Characteristic Tree Species." Characteristic Tree Species include planted species and species identified through inventory of a reference (relatively undisturbed) forest community used to orient the planting plan. All canopy tree species planted and identified in the reference forest will be utilized to define "Characteristic Tree Species" as termed in the success criteria. Table 5 below outlines planted and reference forest species.

Table 5. Planted Species and Reference Forest Ecosystem

Planted Species	Reference Species
Swamp Black Gum (*Nyssa biflora*)	Willow Oak (*Quercus phellos*)
Laurel Oak (*Quercus laurifolia*)	Swamp Chestnut Oak (*Quercus michauxii*)
Swamp Chestnut Oak (*Quercus michauxii*)	Water Oak (*Quercus nigra*)
Cherrybark Oak (*Quercus pagodaefolia*)	Sweet Gum (*Liquidambar styraciflua*)
Water Oak (*Quercus nigra*)	Loblolly Pine (*Pinus taeda*)
Willow Oak (*Quercus phellos*)	Red Maple (*Acer rubrum*)
Sweetbay (*Magnolia virginiana*)	River Birch (*Betula nigra*)
	Swamp Black Gum (*Nyssa biflora*)
	Highbush Blueberry (*Vaccinium corymbosum*)
	Elderberry (*Sambucus canadensis*)
	Sweetbay (*Magnolia virginiana*)
	Horse Sugar (*Symplocos tinctoria*)
	Sweet Pepperbush (*Clethra alnifolia*)
	Ironwood (*Carpinus caroliniana*)
	Spicebush (*Lindera benzoin*)
	American Holly (*Ilex opaca*)

Success criteria dictate that an average density of 320 stems per acre of Character Tree Species must be surviving in the first three monitoring years. Subsequently, 290 Character Tree Species per acre must be surviving in year 4 and 260 Character Tree Species per acre in year 5.

2.1.2 Vegetative Problem Areas

Vegetation sampling across the Site was well-above the required average density with 643 planted stems per acre. No vegetation problem areas were noted during the Year 5 (2011) monitoring season.

2.2 Wetland Assessment

An additional groundwater gauge (Gauge 2.5) was installed prior to Year 5 (2011) approximately 25 feet further into the Site from Gauge 2. Therefore, six groundwater monitoring gauges and two reference groundwater gauge were maintained and monitored throughout the Year 5 (2011) growing season. Graphs of groundwater hydrology and precipitation from an onsite rain gauge are included in Appendix B.

2.2.1 Wetland Success Criteria

Target hydrological characteristics include saturation or inundation for at least 5 percent of the growing season (12 days), during average climatic conditions. This value is based on DRAINMOD simulations for 60 years of rainfall data in an old field stage. These areas are expected to support hydrophytic vegetation. If wetland parameters are marginal as indicated by vegetation and/or hydrology monitoring, a jurisdictional determination will be performed in these areas.

In atypical dry years, the hydroperiod must exceed 75 percent of the hydroperiod exhibited by the reference gauges. Reference gauge data will be used to compare wetland hydroperiods between the restoration areas and relatively undisturbed reference wetlands. This data will supplement regulatory evaluation of success criteria and also provide information that shall allow interpretation of mitigation success in years not supporting "normal" rainfall conditions.

2.2.2 Wetland Problem Areas

No wetland problem areas were identified within the Site during Year 4 (2010) monitoring.

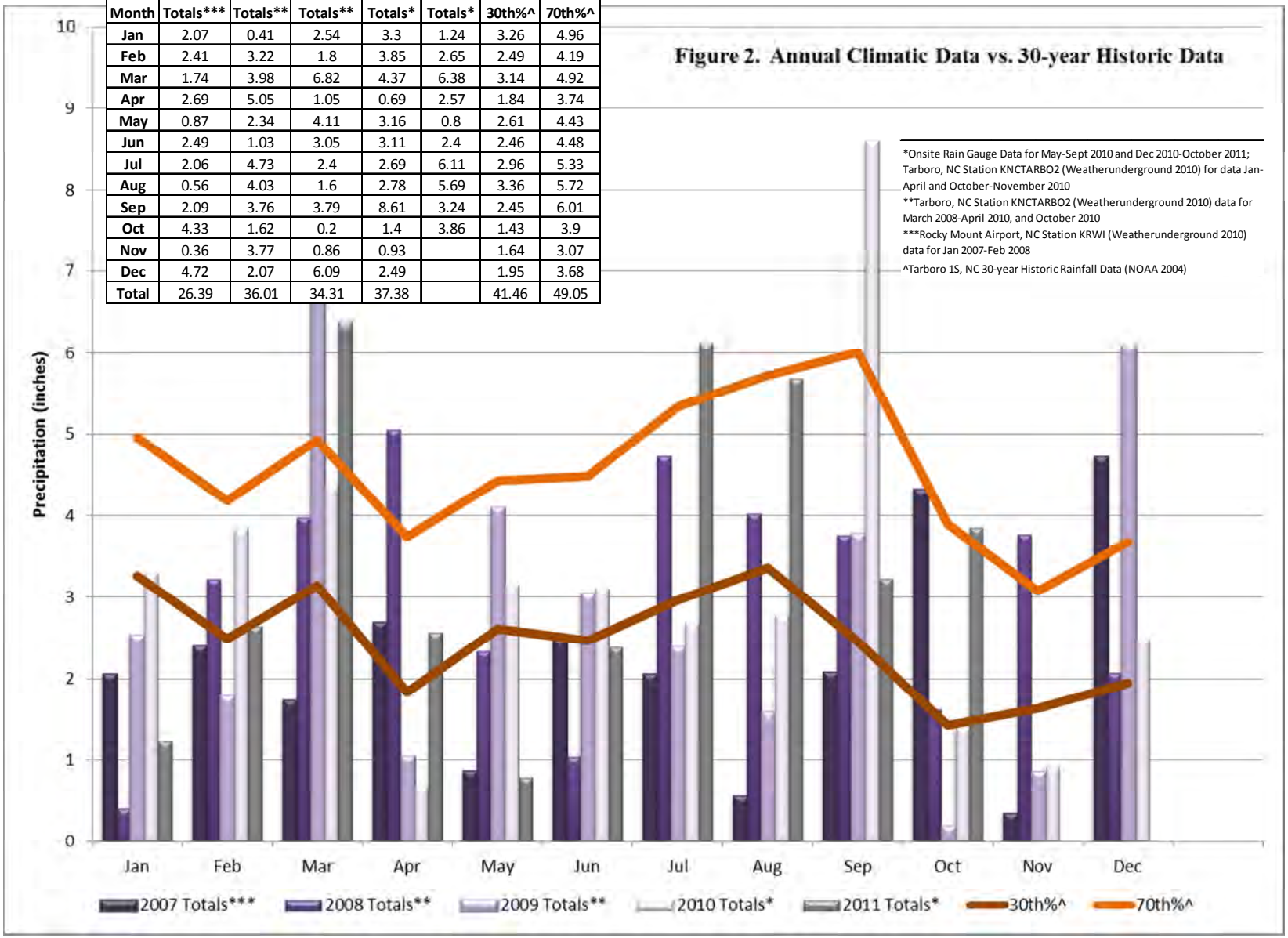
2.2.3 Wetland Criteria Attainment

Three of the five properly functioning monitored gauges within restoration areas were inundated/saturated within 12 inches of the surface for greater than 5 percent of the growing season, which extends from March 21 to November 10 (235 days) (Table 6). Gauge 3 was not functioning properly at the beginning of the growing season and data was unreliable; therefore, the gauge was replaced on May 17, 2011. Based on data from Years 1-4 and visual observations during field visits it is highly likely that this gauge would have met success criteria.

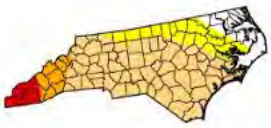
Gauge 2 has fallen below success criteria each year; however, it is located adjacent to the eastern Site boundary, which forms an upland/wetland transition due to groundwater drawdown from a large canal off-site. It appears that as a result of the extended drought the canal may be having an effect on this gauge. Therefore, an additional gauge (Gauge 2.5) was installed approximately 25 feet further into the Site. Gauge 2.5 met success criteria this year with 13.6 percent inundation/saturation. It is anticipated that once rainfall returns to more normal levels for a consistent period of time that Gauge 2 will remain inundated/saturated for an extended period of time.

Gauge 5 is located on an upland/wetland margin and is consistently just below success criteria; however, this gauge has exhibited characteristics almost identical to the reference gauges in all five monitoring years. In addition, rainfall for the Year 5 (2011) growing season was below normal with 34.9 inches of rain occurring from January to October 2011 compared to the 30-year historic mean rainfall of 43.9 inches occurring from January to October (Figures 2 and 3). Since the Year 5 (2011) monitoring season rainfall was below normal, comparisons to reference groundwater gauges were made. Five of the six groundwater gauges should be considered successful for the Year 5 (2011) monitoring period. Hydrographs containing groundwater and precipitation data for each gauge can be found in Appendix B.

Month	2007 Totals***	2008 Totals**	2009 Totals**	2010 Totals*	2011 Totals*	30th%^	70th%^
Jan	2.07	0.41	2.54	3.3	1.24	3.26	4.96
Feb	2.41	3.22	1.8	3.85	2.65	2.49	4.19
Mar	1.74	3.98	6.82	4.37	6.38	3.14	4.92
Apr	2.69	5.05	1.05	0.69	2.57	1.84	3.74
May	0.87	2.34	4.11	3.16	0.8	2.61	4.43
Jun	2.49	1.03	3.05	3.11	2.4	2.46	4.48
Jul	2.06	4.73	2.4	2.69	6.11	2.96	5.33
Aug	0.56	4.03	1.6	2.78	5.69	3.36	5.72
Sep	2.09	3.76	3.79	8.61	3.24	2.45	6.01
Oct	4.33	1.62	0.2	1.4	3.86	1.43	3.9
Nov	0.36	3.77	0.86	0.93		1.64	3.07
Dec	4.72	2.07	6.09	2.49		1.95	3.68
Total	26.39	36.01	34.31	37.38		41.46	49.05



March 13, 2007



May 29, 2007

July 17, 2007

September 4, 2007

October 23, 2007

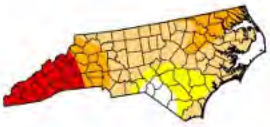
December 18, 2007

February 5, 2008

April 1, 2008

June 10, 2008

July 1, 2008



September 2, 2008

November 4, 2008

January 6, 2009

March 3, 2009

May 5, 2009

July 7, 2009

September 1, 2009

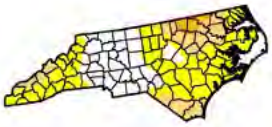
November 3, 2009

January 5, 2010

March 9, 2010

May 4, 2010

July 6, 2010



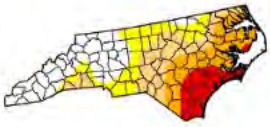
September 7, 2010

November 30, 2010

January 11, 2011

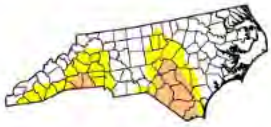
March 15, 2011

May 10, 2011



July 19, 2011

September 13, 2011



November 8, 2011

Table 6. Wetland Criteria Attainment for Year 5 (2011)

Gauge ID	Hydrology Threshold Met?	Hydrophytic Vegetation Criteria Met?	Site Mean	Vegetation Plot ID	Vegetation Survival Threshold Met?	Site Mean
1	Yes	Yes	83 %	1	Yes	100 %
2	No	Yes		2	Yes	
2.5	Yes	Yes		3	Yes	
3	Yes*	Yes		4	Yes	
4	Yes	Yes		5	Yes	
5	Yes	Yes		6	Yes	
				7	Yes	
				8	Yes	
				9	Yes	

*Gauge 3 was not functioning properly at the beginning of the growing season; however, based on previous years data and visual observation it is likely that this gauge would have met success criteria.

3.0 CONCLUSIONS

Wetlands at the Site are developing well despite continued drought conditions with the development of hydrophytic herbaceous vegetation and hydric soil characteristics. Based on recent field visits, gauge data, rain data, and jurisdictional wetland delineations, wetlands at the Site should be considered successful.

Three gauges (Gauges 1, 3, and 4) have consistently met success criteria being inundated or saturated for greater than 5 percent of the growing season despite drought conditions during all five monitoring years. Gauge 3 was not functioning properly at the beginning of the Year 5 (2011) growing season and data was unreliable; therefore, the gauge was replaced on May 17, 2011. Based on data from Years 1-4 and visual observations during field visits it is highly likely that this gauge would have met success criteria.

Gauge 2 has fallen below success criteria each year; however, it is located adjacent to the eastern Site boundary, which forms an upland/wetland transition due to groundwater drawdown from a large canal off-site. It appears that as a result of the extended drought the canal may be having an effect on this gauge. Therefore, an additional gauge (Gauge 2.5) was installed approximately 25 feet further into the Site. Gauge 2.5 met success criteria this year with 13.6 percent inundation/saturation. It is anticipated that once rainfall returns to more normal levels for a consistent period of time that Gauge 2 will remain inundated/saturated for an extended period of time.

Gauge 5 is located on an upland/wetland margin and is consistently just below success criteria; however, this gauge has exhibited characteristics almost identical to the reference gauges in all five monitoring years. Due to less than normal rainfall throughout the 5-year monitoring period, this gauge should be compared to reference gauges for success and should be considered successful. A summary of groundwater gauge data for the entire monitoring period is included in Table 7.

Table 7. Summary of Groundwater Gauge Results

Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Year 1 (2007)*	**Year 2 (2008)***	**Year 3 (2009)***	**Year 4 (2010)***	**Year 5 (2011)***
1	Yes/15 days (6 percent)	Yes/60 days (26 percent)	Yes/32 days (13.6 percent)	Yes/28 days (11.9 percent)	Yes/35 days (14.9 percent)
2	No/1 days (0.4 percent)	No/2 days (0.8 percent)	No/2 days (0.8 percent)	Yes/6 days (2.6 percent)	No/2 days (0.8 percent)
2.5	--	--	--	--	Yes/32 days (13.6 percent)
3	Yes/15 days (6 percent)	Yes/38 days (16 percent)	Yes/30 days (12.8 percent)	Yes/17 days (7.2 percent)	**
4	Yes/6 days (3 percent)	Yes/31 days (13 percent)	Yes/23 days (9.8 percent)	Yes/21 days (8.9 percent)	Yes/17 days (7.2 percent)
5	Yes/7 days (3 percent)	Yes/5 days (2 percent)	Yes/8 days (3.4 percent)	Yes/10 days (4.3 percent)	Yes/8 days (3.4 percent)
Ref 1	7 days (3 percent)	5 days (2 percent)	6 days (2.6 percent)	6 days (2.6 percent)	6 days (2.6 percent)
Ref 2	7 days (3 percent)	5 days (2 percent)	7 days (3.0 percent)	7 days (3.0 percent)	14 days (6.0 percent)

* Rainfall was below normal; therefore, Site gauges were compared to reference gauges for success.

**Gauge 3 was not functioning properly at the beginning of the Year 5 (2011) growing season and data was unreliable; therefore, the gauge was replaced on May 17, 2011. Based on data from Years 1-4 and visual observations during field visits it is highly likely that this gauge would have met success criteria.

Vegetation plots across the Site were above the required 260 stems per acre with an average of 643 tree stems per acre in the Year 5 (2011) (Table 8). In addition, each individual vegetation plot met success criteria in all five monitoring years.

Table 8. Summary of Planted Vegetation Plot Results

Plot	Planted Stems/Acre Counting Towards Success Criteria				
	Year 1 (2007)	**Year 2 (2008)**	**Year 3 (2009)**	**Year 4 (2010)**	**Year 5 (2011)**
1	607	445	364	526	526
2	931	931	931	971	971
3	607	607	688	728	728
4	647	769	809	769	809
5	324	486	526	486	364
6	688	728	728	688	647
7	364	526	526	567	526
8	324	647	607	647	647
9	405	526	526	526	567
Average of All Plots (1-9)	**544**	**630**	**634**	**656**	**643**

4.0 REFERENCES

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. United States Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

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

National Oceanic and Atmospheric Administration (NOAA). 2004. Climatography of the United States No. 20; Monthly Station Climate Summaries, 1971-2000. National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service, National Climatic Data Center, Asheville, North Carolina.

Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology (Publisher). Pagosa Springs, Colorado.

Weakley, Alan S. 2007. Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas (online). Available: http://www.herbarium.unc.edu/WeakleysFlora.pdf [February 1, 2008]. University of North Carolina Herbarium, North Carolina Botanical Garden, University of North Carolina, Chapel Hill, North Carolina.

Weather Underground. 2010. Station in Tarboro (KNCTARBO2) and Rocky Mount Airport (KWRI), North Carolina. (online). Available: http://www.wunderground.com/weatherstation/WXDailyHistory.asp?ID=KNCTARBO2&graphspan=custom&month=3&day=1&year=2008&monthend=10&dayend=31&yearend=2008 [November 16, 2010]. Weather Underground.

APPENDIX A
VEGETATION DATA

1. **Vegetation Survey Data Tables**
2. **Vegetation Monitoring Plot Photos**

CVS Database Survey Data Tables

Living planted stems, excluding live stakes, per acre: Negative (red) numbers indicate the project failed to reach requirements in a particular year.

Project Code	Project Name	River Basin	Year 2011
Anderson	Anderson Swamp	Tar-Pamlico	643.00

Total stems, including planted stems of all kinds (including live stakes) and natural/volunteer stems:

Project Code	Project Name	River Basin	Year 2011
Anderson	Anderson Swamp	Tar-Pamlico	5409.298095

Vigor

vigor	Count	Percent
0	2	1.3
2	1	0.7
3	22	14.5
4	120	78.9
Missing	7	4.6

Vigor by Species

Species	CommonName	4	3	2	1	0	Missing	Unknown
Betula nigra	river birch	1						
Nyssa biflora	swamp tupelo		2				1	
Quercus michauxii	swamp chestnut oak	25	2					
Quercus nigra	water oak	22	3				1	
Quercus pagoda	cherrybark oak	34	2				2	
Quercus phellos	willow oak	31	4					
Magnolia virginiana	sweetbay	3	2	1		2	3	
Nyssa	tupelo	3	3					
Ulmus	elm	1	4					
9	**9**	**120**	**22**	**1**		**2**	**7**	

Damage

Damage	Count	Percent Of Stems
(no damage)	149	98
Deer	2	1.3
Unknown	1	0.7

Damage by Species

Species	CommonName	Count of Damage Categories	(no damage)	Deer	Diseased
Betula nigra	river birch	0	1		
Magnolia virginiana	sweetbay	1	10		1
Nyssa	tupelo	2	4	2	
Nyssa biflora	swamp tupelo	0	3		
Quercus michauxii	swamp chestnut oak	0	27		
Quercus nigra	water oak	0	26		
Quercus pagoda	cherrybark oak	0	38		
Quercus phellos	willow oak	0	35		
Ulmus	elm	0	5		
9	**9**	**3**	**149**	**2**	**1**

Damage by Plot

plot	Count of Damage Categories	(no damage)	Deer	Diseased
1	0	13		
2	0	24		
3	0	18		
4	0	22		
5	0	13		
6	1	17		1
7	0	14		
8	2	14	2	
9	0	14		
9	**3**	**149**	**2**	**1**

Plot Information

Plot	Plot Level	Year	Planted Living Stems	Planted Living Stems EXCLUDING Live Stakes	Dead/Missing Stems	Natural (Volunteer) Stems	Total Living Stems	Total Living Stems EXCLUDING Live Stakes	Planted Living Stems per ACRE	Planted Living Stems EXCLUDING Live Stakes PER ACRE	Natural (Volunteer) Stems PER ACRE	Total Living Stems PER ACRE	Total Living Stems EXCLUDING Live Stakes PER ACRE	# species
1	2	5	13	13	0	35	48	48	526	526	1416	1942	1942	3
2	2	5	24	24	0	54	78	78	971	971	2185	3157	3157	3
3	2	5	18	18	0	76	94	94	728	728	3076	3804	3804	4
4	2	5	20	20	2	215	235	235	809	809	8701	9510	9510	2
5	2	5	9	9	4	303	312	312	364	364	12262	12626	12626	5
6	2	5	16	16	2	29	45	45	647	647	1174	1821	1821	4
7	2	5	13	13	1	174	187	187	526	526	7042	7568	7568	4
8	2	5	16	16	0	134	150	150	647	647	5423	6070	6070	4
9	2	5	14	14	0	40	54	54	567	567	1619	2185	2185	5

Planted Stems by Plot

Species	Common Name	Stems	# plots	1	2	3	4	5	6	7	8	9
Betula nigra	river birch	1	1									1
Magnolia virginiana	sweetbay	6	3					2	2		2	
Nyssa	tupelo	6	2					1			5	
Nyssa biflora	swamp tupelo	2	1					2				
Quercus michauxii	swamp chestnut oak	27	3		17	8				2		
Quercus nigra	water oak	25	6	6		3		3	8	4		1
Quercus pagoda	cherrybark oak	36	8	5	1	5	12	1	3		5	4
Quercus phellos	willow oak	35	8	2	6	2	8		3	4	4	6
Ulmus	elm	5	2							3		2
9	**9**	**143**	**9**	**13**	**24**	**18**	**20**	**9**	**16**	**13**	**16**	**14**

Total Stems by Plot (Includes Planted and Natural Recruit Stems)

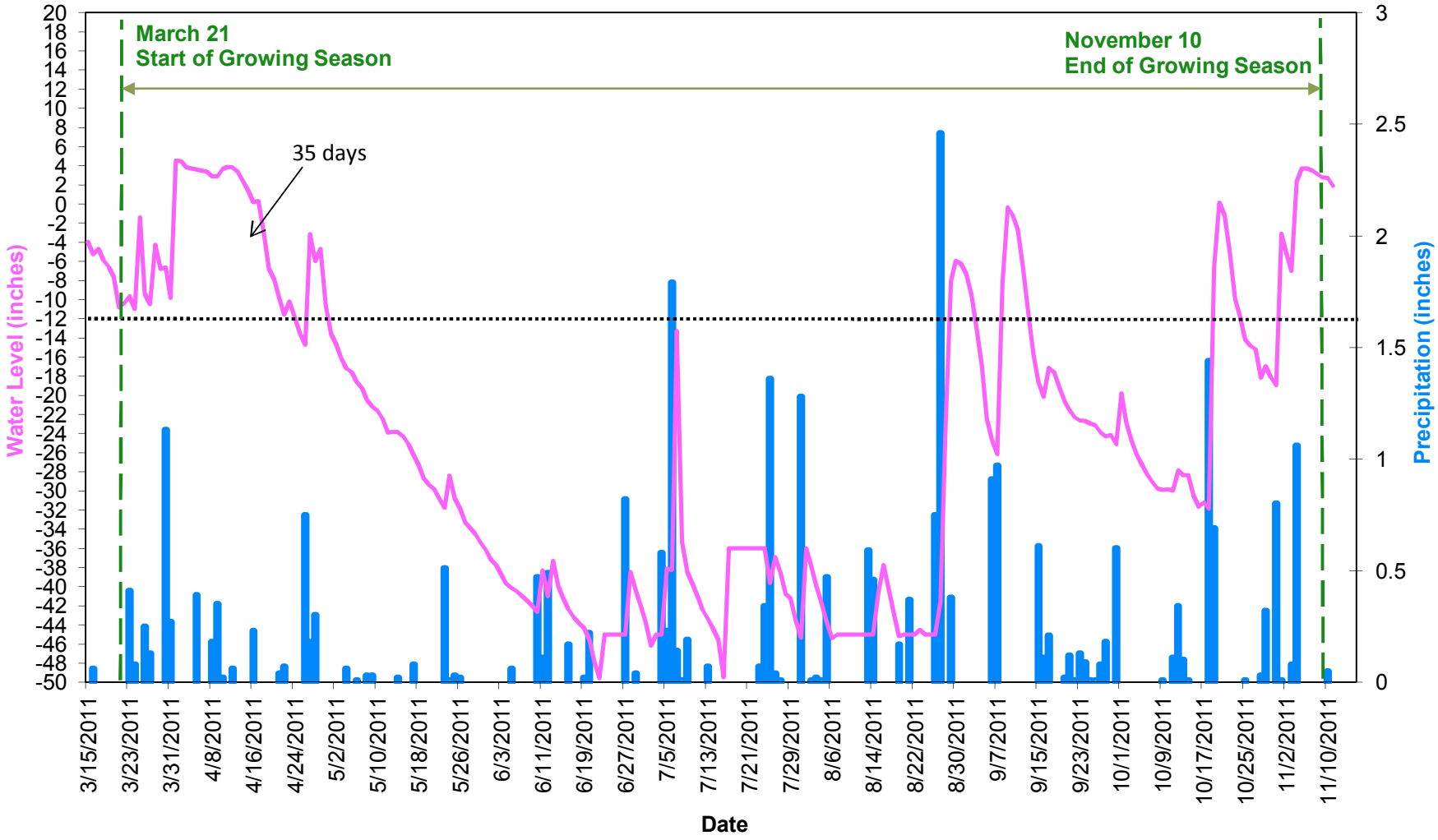
Species	Common Name	Stems	# plots	1	2	3	4	5	6	7	8	9
Acer rubrum	red maple	6	2								5	1
Baccharis halimifolia	eastern baccharis	13	4	2	7	1		3				
Betula nigra	river birch	4	3	1			2					1
Liquidambar styraciflua	sweetgum	351	8	2	16	13	61	2		120	110	27
Magnolia virginiana	sweetbay	8	3					4	2		2	
Nyssa	tupelo	12	3		6			1			5	
Nyssa biflora	swamp tupelo	2	1					2				
Pinus taeda	loblolly pine	676	9	29	25	62	151	298	28	53	18	12
Quercus michauxii	swamp chestnut oak	27	3		17	8				2		
Quercus nigra	water oak	25	6	6		3		3	8	4		1
Quercus pagoda	cherrybark oak	37	8	5	1	5	13	1	3		5	4
Quercus phellos	willow oak	35	8	2	6	2	8		3	4	4	6
Salix	willow	2	2						1		1	
Ulmus	elm	7	3	1						4		2
14	**14**	**1205**	**14**	**48**	**78**	**94**	**235**	**314**	**45**	**187**	**150**	**54**

Anderson Swamp Wetland Restoration Site
Year 5 (2011) Annual Monitoring
Vegetation Plot Photos
Taken July 2011

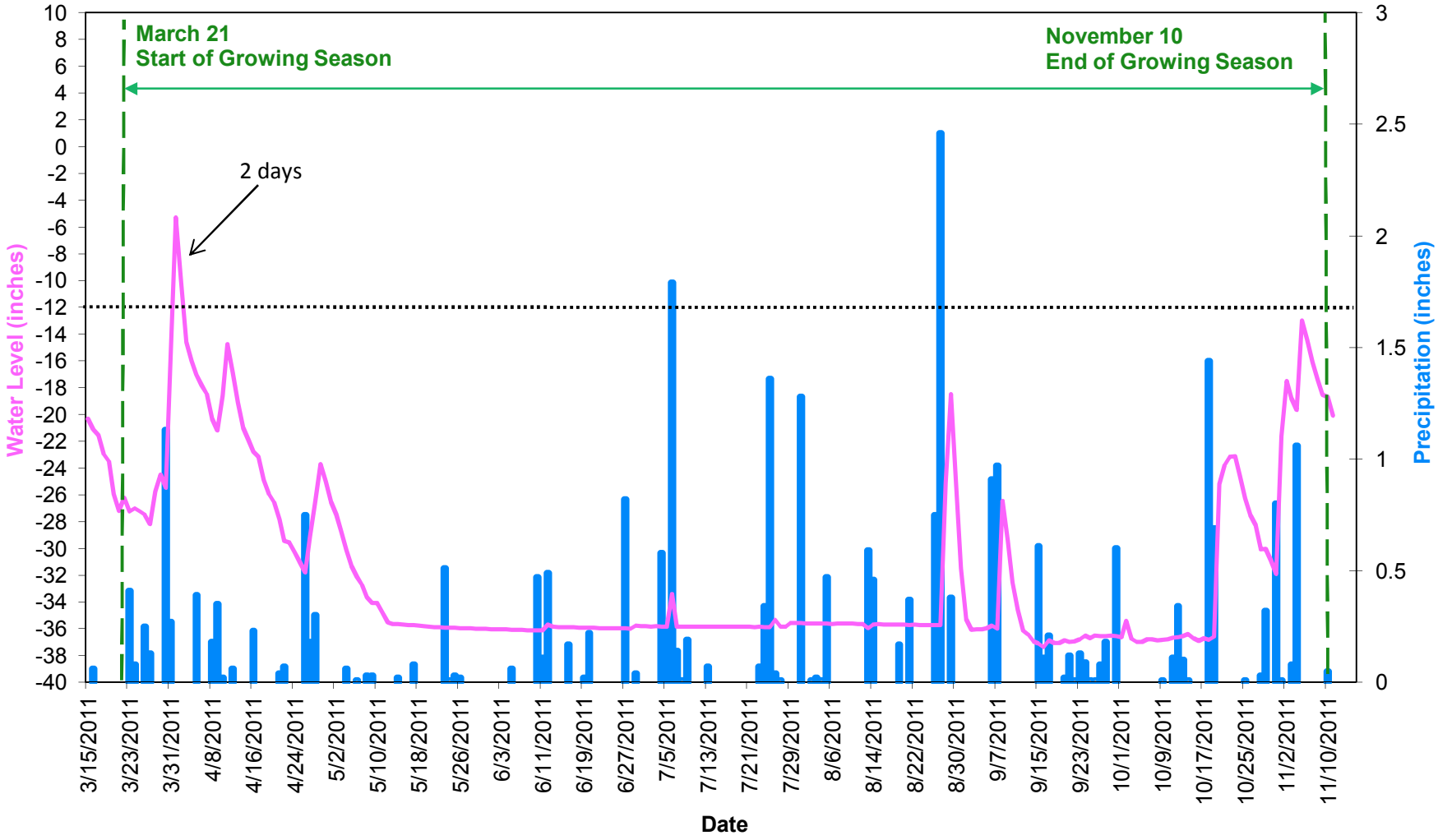
Anderson Swamp Wetland Restoration Site
Year 5 (2011) Annual Monitoring
Vegetation Plot Photos
Taken July 2011
(continued)

APPENDIX B
HYDROLOGY DATA
2011 Groundwater Gauge Graphs

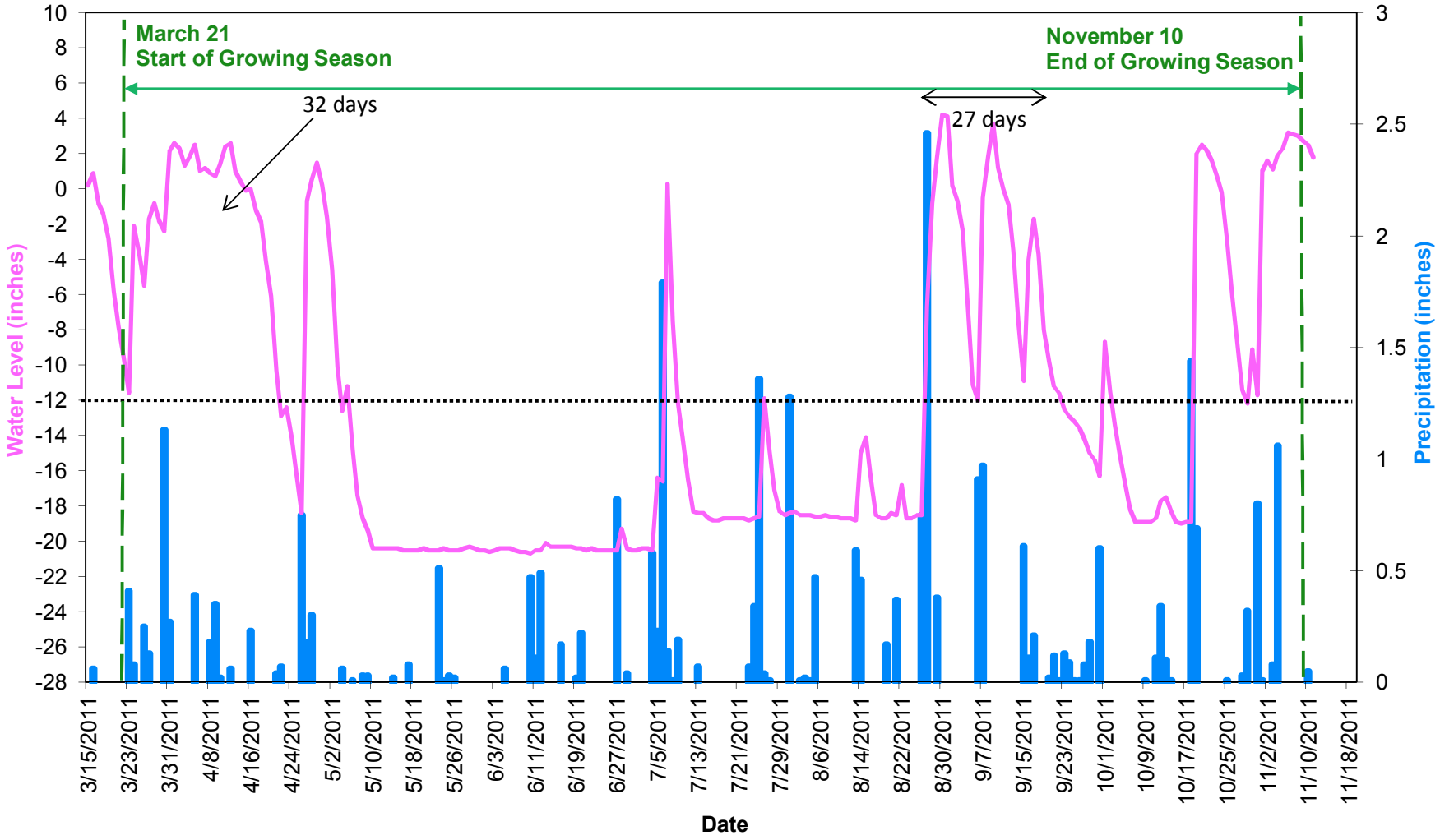
Anderson Swamp Groundwater Gauge 1
Year 5 (2011 Gauge Data)



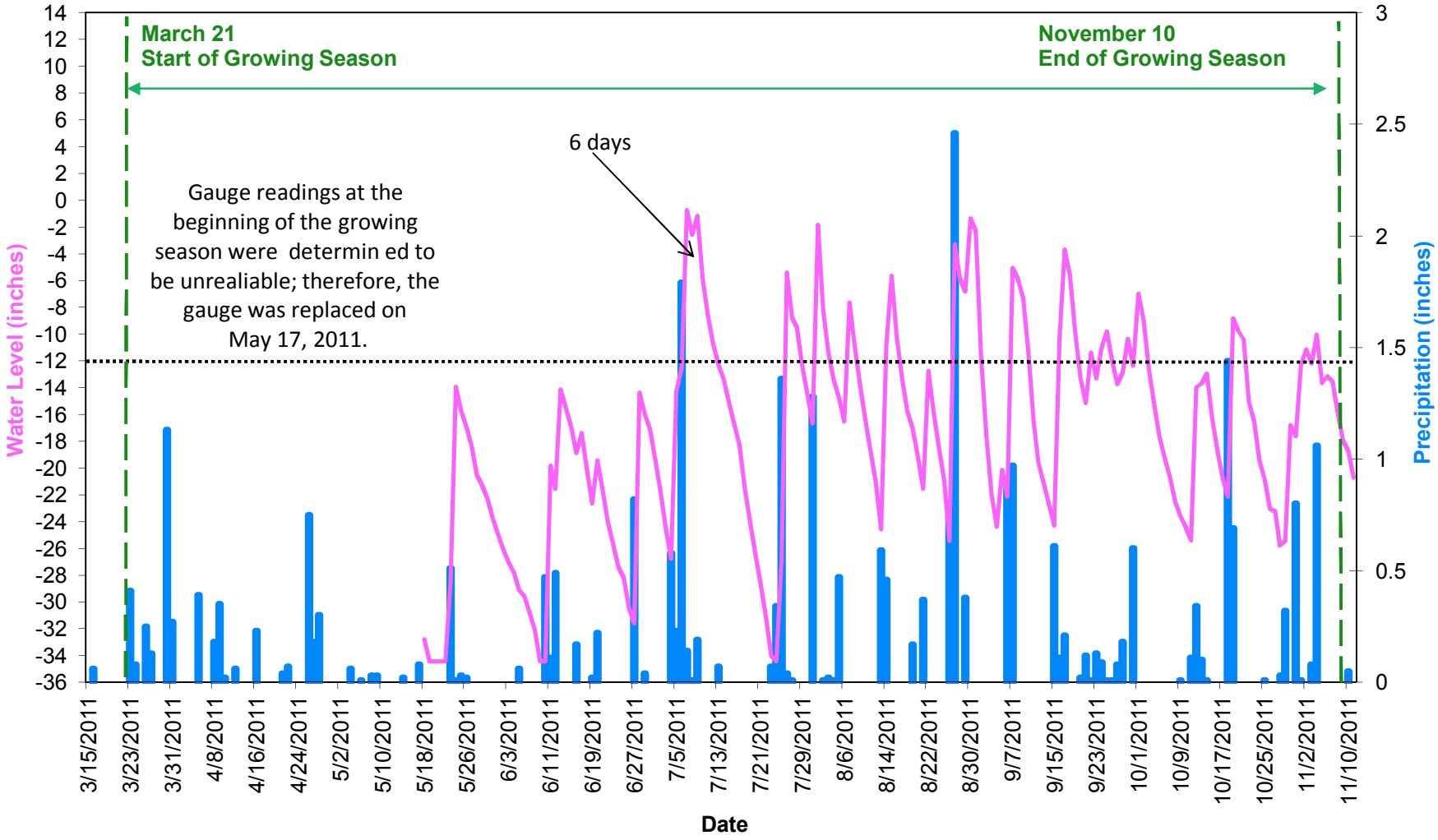
Anderson Swamp Groundwater Gauge 2
Year 5 (2011 Gauge Data)



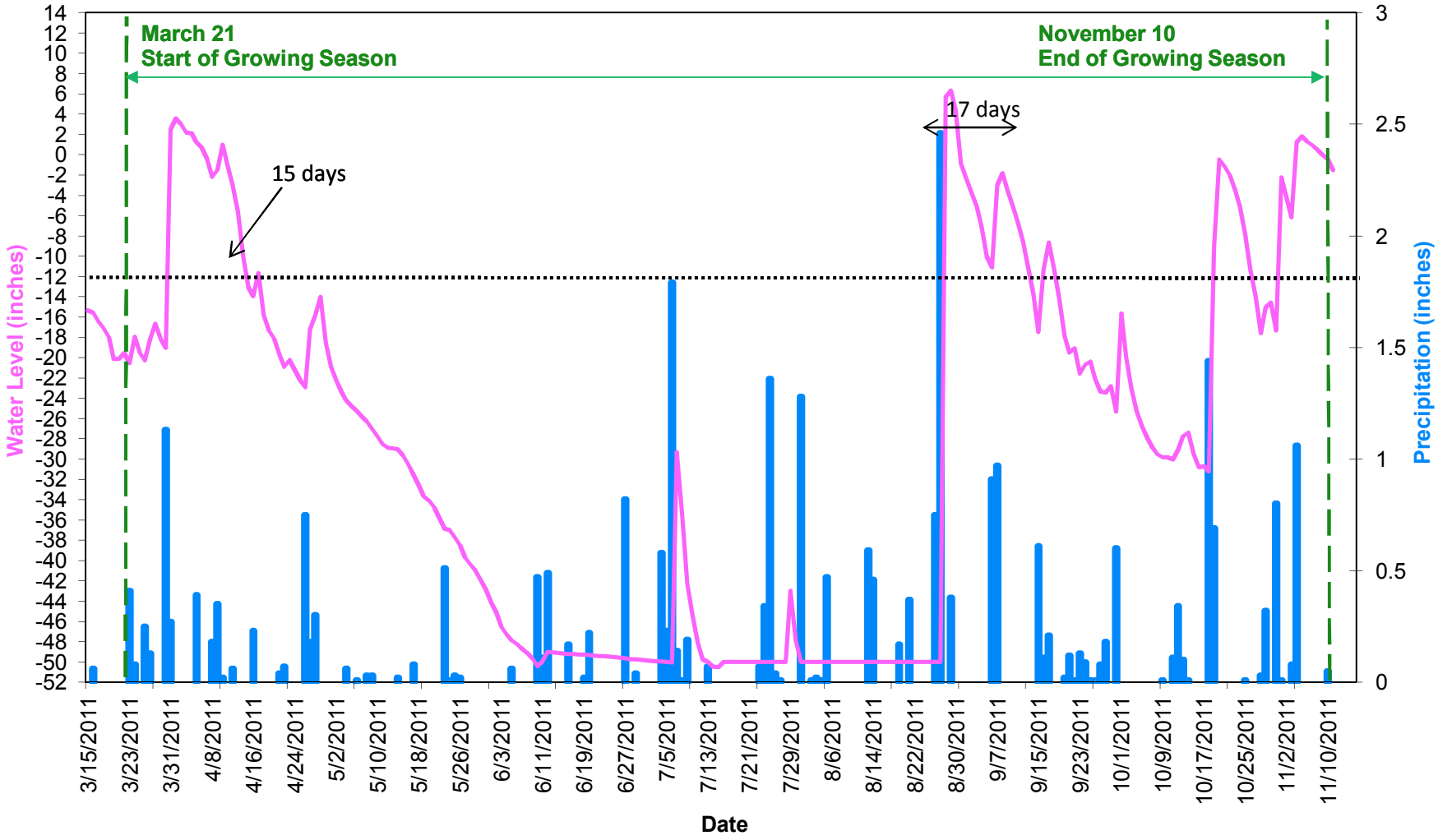
Anderson Swamp Groundwater Gauge 2.5
Year 5 (2011 Gauge Data)



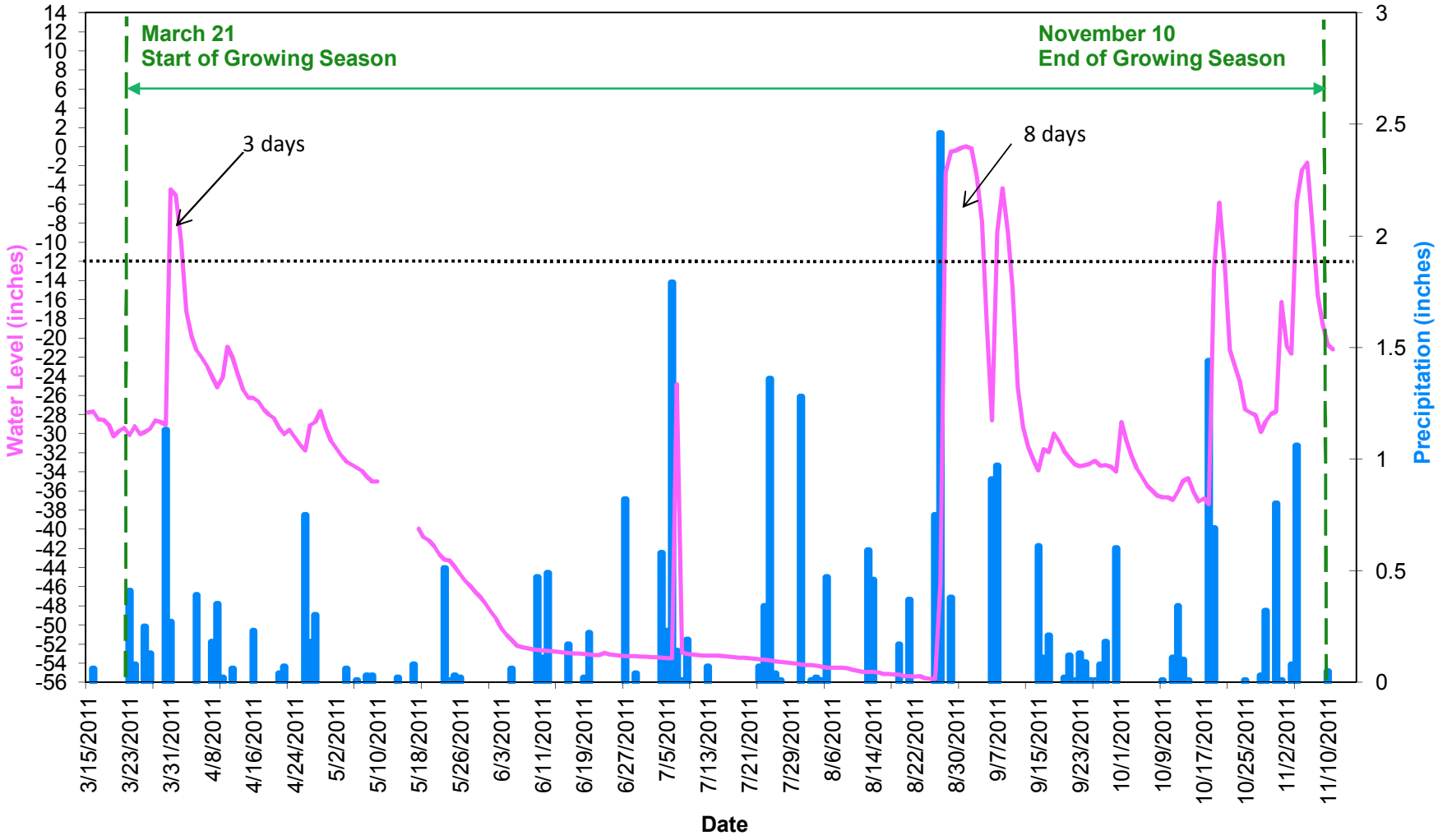
Anderson Swamp Groundwater Gauge 3
Year 5 (2011 Gauge Data)



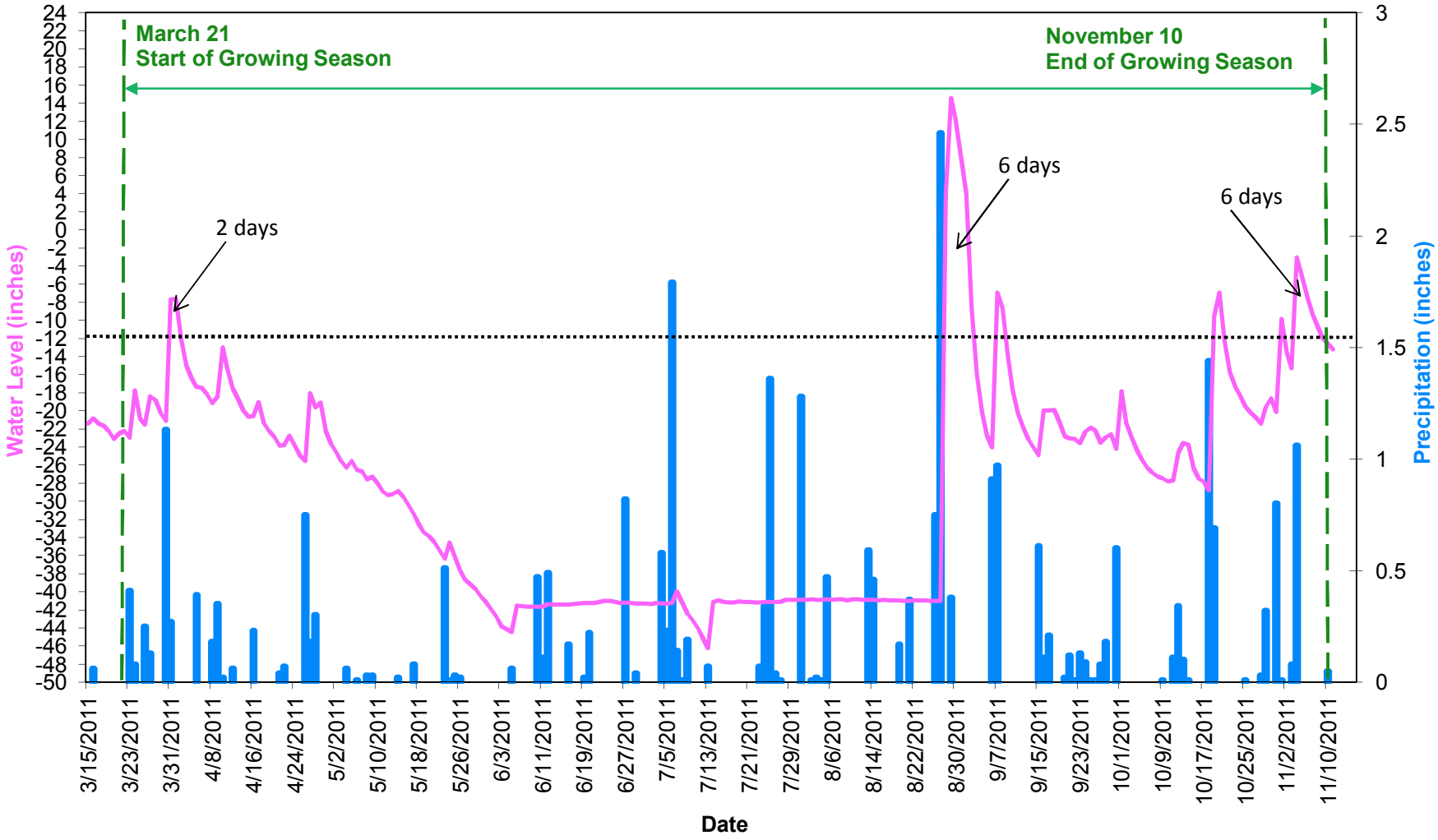
Anderson Swamp Groundwater Gauge 4
Year 5 (2011 Gauge Data)



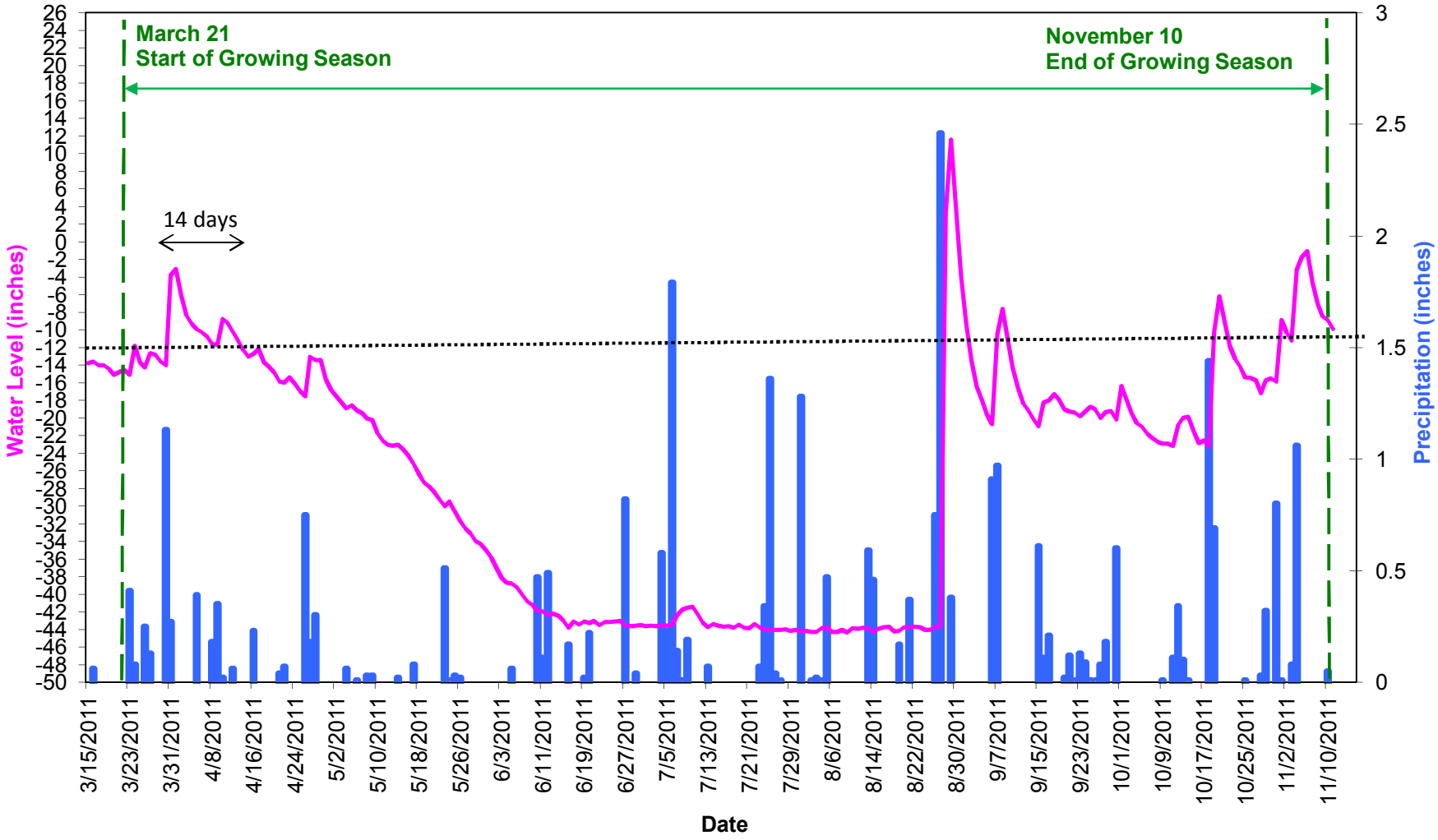
Anderson Swamp Groundwater Gauge 5
Year 5 (2011 Gauge Data)



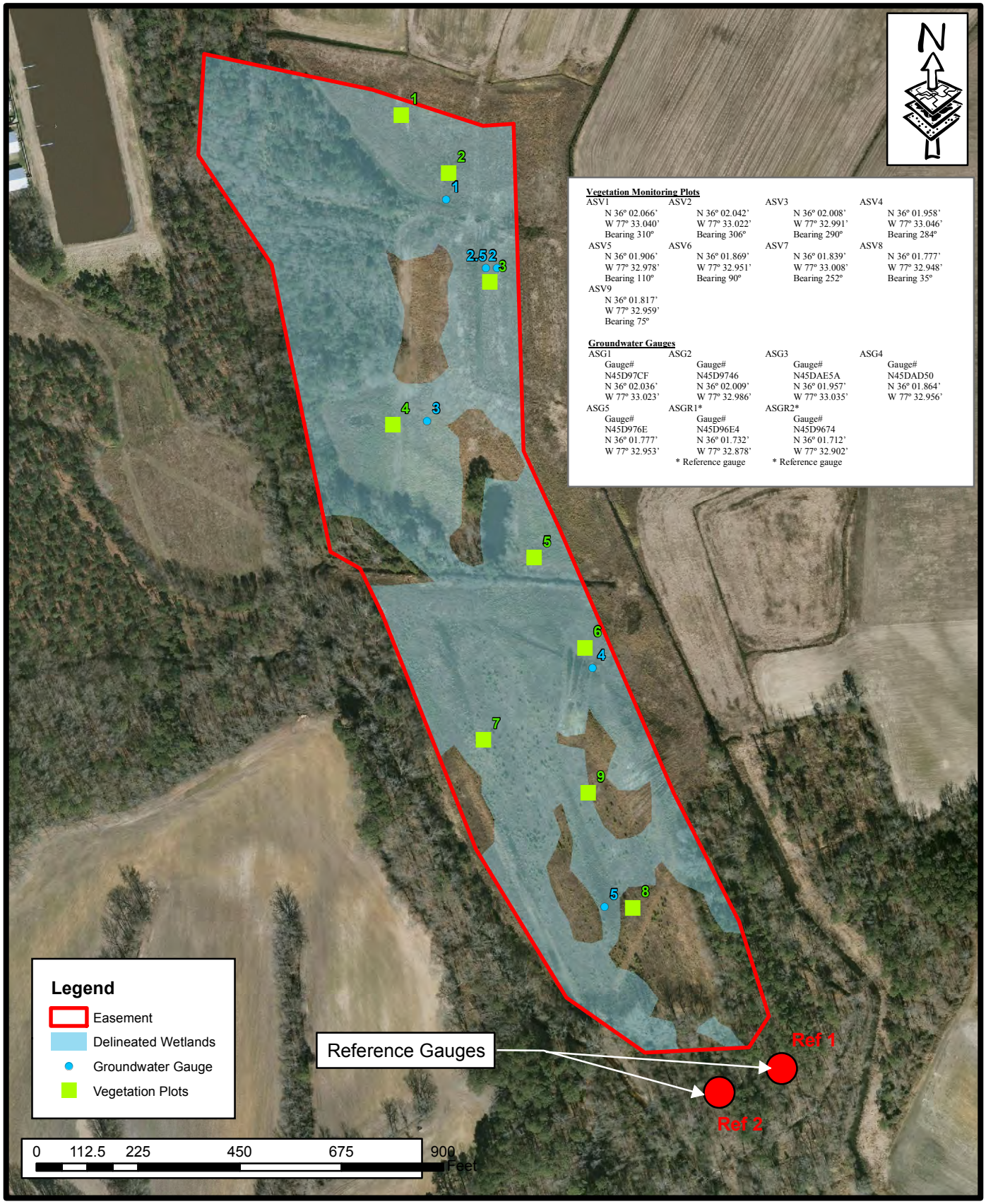
Anderson Swamp Groundwater Gauge Reference 1
Year 5 (2011 Gauge Data)



Anderson Swamp Groundwater Gauge Reference 2
Year 5 (2011 Gauge Data)



APPENDIX C
MONITORING PLAN VIEW



Axiom Environmental, Inc.
218 Snow Avenue
Raleigh, NC 27603
(919) 215-1693

MONITORING PLAN
ANDERSON SWAMP RESTORATION SITE
Edgecombe County, North Carolina

Dwn. By:	CLF
Date:	Nov 2011
Project:	10-001
FIGURE	C1