

**Bishop Road Wetland Mitigation Site  
Monitoring Year 4 (2012)**

**Hyde County, NC  
State Construction Office Project No. 05-0653802**

**EEP Project No. 38**



**Prepared for the  
NC Department of Environment and Natural Resources  
Ecosystem Enhancement Program**



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

**Final Monitoring Report**

**December 2012**

**Prepared by:**



1151 SE Cary Parkway, Suite 101  
Cary, NC 27518  
919.557.0929

---

G. Lane Sauls, Jr., Principal

*This document is based on the NCDENR Ecosystem Enhancement Program's Monitoring Report Submission Template Version 1.2 (dated 11/06/06) in the Project Implementation Manual.*

## Table of Contents

	<u>Page</u>
<b>Executive Summary/ Project Abstract.....</b>	<b>2</b>
<b>1.0 Project Background .....</b>	<b>3</b>
1.1 Project Objectives.....	3
1.2 Project Structure.....	3
1.3 Restoration Type and Approach .....	4
1.3.1 Coastal Marsh Wetlands.....	4
1.3.2 Non-Riparian Hardwood Flat Wetlands.....	4
1.3.3 Riverine Forested Wetlands .....	5
1.4 Location and Setting .....	5
1.5 Project History and Background .....	5
<b>2.0 Project Condition and Monitoring Results.....</b>	<b>9</b>
2.1 Vegetation Assessment .....	9
2.1.1 Vegetation Problem Areas.....	9
2.2 Wetland Assessment .....	10
2.2.1 Wetland Problem Areas.....	10
<b>3.0 Methodology .....</b>	<b>12</b>
<b>4.0 References .....</b>	<b>13</b>

### Figures

- Figure 1. Project Site Vicinity Map
- Figure 2. Project Attributes
- Figure 3. Vegetation Problem Areas Plan View
- Figure 4. Monitoring Well Locations

### Tables

Exhibit Table I. Project Restoration Components.....	6
Exhibit Table II. Project Activity and Reporting History.....	7
Exhibit Table III. Project Contact Table .....	7
Exhibit Table IV. Project Background Table .....	8
Exhibit Table V. Wetland Criteria Attainment .....	11

### Appendices

- Appendix A. Vegetation Raw Data and Annual Photograph Comparisons
- Appendix B. Wetland Raw Data

## Executive Summary/ Project Abstract

The Bishop Road Wetland Mitigation Site, hereinafter referred to as the Bishop Road Site or Project Site, is one of a group of sites purchased by the NC Department of Transportation (NCDOT) to meet its ongoing mitigation needs throughout North Carolina. In 2006, the Project Site was turned over to the NC Department of Environment and Natural Resources, Ecosystem Enhancement Program (EEP) for project implementation. Construction was completed during the spring of 2009.

Ecological Engineering, LLP (Ecological Engineering) entered into contract with EEP in October 2009. As part of this contract, Ecological Engineering was tasked to provide annual monitoring services including, but not limited to annual vegetation assessments within the existing nine vegetation plots and the downloading of monitoring well data at 12 locations. During 2010, Ecological Engineering added three additional vegetation plots to the overall assessment. In 2012, two wells were removed due to ongoing wildlife damage. The downloading of well data occurred three times during 2012. Additional services, including well maintenance and replacement, were also provided, as necessary.

The Bishop Road Site is situated along SR 1156 (Bishop Road), between US 264 and the Pungo River in Hyde County, North Carolina (Figure 1). It is approximately one mile north of Scranton, five miles southeast of Leechville and ten miles east of Belhaven. The Project Site is bordered to the northwest by Tarklin Creek, the south by Scranton Creek and the west by the Pungo River. It is within the Tar-Pamlico River Basin, Hydrologic Unit Code (HUC) 03040104.

### Vegetation Assessment

The Monitoring Year (MY) 4 vegetation monitoring effort was performed by determining density and survival of planted species, consistent with prescribed Carolina Vegetation Survey (CVS) protocols. Nine 100-meter<sup>2</sup> (wetland) and three 50-meter<sup>2</sup> (buffer) plot locations were assessed. Based on the 2012 assessment, the mean stem count for all of the plots combined totaled approximately 191 planted stems per acre and 2,146 total stems per acre. The MY 3 means were approximately 235 planted stems per acre and 3,549 total stems per acre. Six of nine wetland plots and zero of three buffer plots met the 260-count and 320-count thresholds, respectively required for Year 5 results. Of the remaining three wetland plots, one exhibited planted stem counts at approximately 40 stems per acre and two exhibited no planted stems. No planted stems were observed within the three buffer plots. Supplemental planting was implemented as part of the construction warranty during early 2010 and will be required again to meet minimum number thresholds.

### Wetland Assessment

Wetland assessments associated with the MY 4 monitoring effort were performed by collecting groundwater hydrology via monitoring wells that record daily groundwater elevations. Based on the results, all 10 wells met the criteria established for wetland hydrology.

## 1.0 Project Background

### 1.1 Project Objectives

The project goals were to restore site hydrology, restore natural diverse wetland communities and protect the site from vehicle access, logging or development (EEP, 2009). These goals were accomplished by the following objectives:

- Removal of earthen roads and fill roadside drainage ditches;
- Removal of bedding rows in selected areas, replanting and establishing natural plant communities, non-riparian hardwood flats, coastal marshes and riverine forested wetlands; and,
- Purchase of the property fee simple, record a conservation easement for protection in perpetuity and installation vehicle access barriers.

The system of measurement to determine successful implementation includes documentation of hydrology through groundwater monitoring wells, documentation of vegetation development through permanent 100-meter<sup>2</sup> plots and documentation of no vehicle access, logging or development through visual observation (EEP, 2009).

### 1.2 Project Structure

Mitigation components include coastal marsh restoration and preservation, riverine forested wetland restoration and preservation, non-riparian hardwood flat restoration and preservation and riparian buffer restoration. Figure 2 depicts the locations of each mitigation component. Exhibit Table 1 denotes the final calculated acreages of each component.

According to EEP (2009), the restoration types and amounts were modified during construction due to plant community nomenclature and inaccuracy of the topographic survey. These modifications deviate significantly from names and amounts presented in the 2006 Restoration Plan. Approximately 36.0 acres of non-riparian hardwood flat restoration were removed to reduce construction costs. The tidal freshwater marsh community is now referred to coastal marsh per the request of EEP and the NC Division of Coastal Management. A 2.2-acre section of tidal freshwater marsh/coastal marsh located west of Old Bishop Road was changed to non-riparian hardwood flat due to inaccurate survey elevations. The design was based on topographic survey information provided by a third party. Based on the survey elevations and its proximity to open water, this area was slated for marsh restoration. After the area was cleared during construction, it was obvious that the area was significantly higher than the survey depicted. A small section of non-riparian hardwood flat restoration (0.171 acres) was changed to riparian buffer restoration. This change resulted from the need of riparian buffer credits in the area (EEP, 2009).

Vehicle access barriers comprised of concrete Jersey barriers, an earthen berm and a metal gate were installed at strategic locations within the Project Site.

### 1.3 Restoration Type and Approach

#### 1.3.1 Coastal Marsh Wetlands

According to EEP (2009), the restoration plan includes 0.343 acres of coastal marsh restoration at two locations. The first and larger area, covering 0.246 acres, is located at the northern end of Bishop Road along the main branch of Tarklin Creek. The area consisted of an earthen road bed approximately 32 feet wide and approximately 2.5 feet higher than the adjacent marsh. Restoration was accomplished by removing the earthen fill to an elevation within  $\pm 0.2$  feet of the adjacent marsh. The fill material was used to raise the elevation of the adjacent to the same elevation as the marsh and regraded road. The restored area was planted with vegetation representative of the adjacent marsh, included black needle rush (*Juncus roemerianus*), Sawgrass (*Cladium jamaicense*), smooth cordgrass (*Spartina alterniflora*) and pickerelweed (*Pontederia cordata*). Soils in the marsh consist of Longshoal mucky peat, a hydric A soil (EEP, 2009).

The second and smaller area, covering 0.097 acres, is situated near the end of Silverthorne Road. Silverthorne Road crosses a small tidal slough of Scranton Creek at this location. There was no culvert under Silverthorne Road at this location. This disconnected the small slough upstream of Silverthorne Road from tidal flow. Sawgrass (*Cladium jamaicense*) is the dominant vegetation on the downstream (the tidal side) of the road. The upstream side was dominated by bare ground. This significant difference in vegetation is a result of the disconnection from tidal flow. The roadway was removed and graded to an elevation within  $\pm 0.2$  feet of the adjacent slough elevations and replanted with the same suite of coastal marsh herbaceous vegetation as the above location. Soils in the area consist of Bolling loamy fine sand, a hydric B soil (EEP, 2009).

NC Division of Coastal Management (DCM) representative Steve Trowell inspected both coastal marsh restoration areas during construction. Final construction elevations of the coastal marsh areas were provided to DCM and concurrence was granted on May 26, 2009.

#### 1.3.2 Non-Riparian Hardwood Flat Wetlands

According to EEP (2009), the non-riparian hardwood flat restoration areas include 56.3 acres of non-jurisdictional areas within the existing planted pine and roadbed areas throughout the Project Site. These areas exhibited hydric soils; however, they did not meet the other two parameters necessary for jurisdictional status. Non-riparian hardwood flat restoration was accomplished by clearing and grubbing non-jurisdictional 10 to 15 year old loblolly pine plantation then replanting the area with the appropriate wetland vegetation. The bedding rows were graded to a more natural contour. Existing roadways were also removed and adjacent ditches were filled with the roadbed material to the elevation of the adjacent non-riparian hardwood flat community. The depth of cut on the roadways averages around 1.5 feet. The depth of the adjacent ditches averaged around 2.5 feet. These areas were also replanted. Soils within the non-riparian hardwood flat restoration areas consist of Acredale silt loam, Argent loam, Chapanoke silt loam and Yeopin silt loam, all of which are hydric. The Site was cleared by first removing the pine trees. Trees were cut at the base, leaving the roots in the ground, and then chipped. The chips were hauled off site. Branches and bark were burned on site. The tree roots were grubbed using a "rake" attached to a track excavator. This also removed the bedding rows. Root material was burned on site (EEP, 2009).

### 1.3.3 Riverine Forested Wetlands

According to EEP (2009), the restoration plan provided restoration of 1.0 acre of riverine forested wetland. Riverine forested wetlands restoration was accomplished by removing an earthen road bed. The road material was used to fill drainage ditches adjacent to the roadbed. Target restoration elevations were designed to be within  $\pm 0.2$  feet of the adjacent target community elevations. An initial survey revealed that the desired elevations had not been met. The contractor was required to re-grade the area to design specifications. A post construction topographic survey verified that final elevations were within the target range. Soils within the adjacent riverine wetlands consist of Belhaven muck, a hydric A soil. Trees removed to accomplish the riverine wetland restoration were a few 10 to 15 year old loblolly pines located along the ditch banks. After clearing, grubbing and grading, the area was replanted with riverine wetland species, including bald cypress (*Taxodium distichum*), water tupelo (*Nyssa aquatica*), tag alder (*Alnus serrulata*) and various oaks (*Quercus* spp.) (EEP, 2009).

## 1.4 **Location and Setting**

The Bishop Road Site is situated along SR 1156 (Bishop Road), between US 264 and the Pungo River in Hyde County, North Carolina. It is approximately one mile north of Scranton, five miles southeast of Leechville and ten miles east of Belhaven. The Project Site is bordered to the northwest by Tarklin Creek, the south by Scranton Creek and the west by the Pungo River. The remainder of the Project Site is bordered by roads, managed timber areas, agricultural fields and wooded or undeveloped lands. The Project Site is within the Tar-Pamlico River Basin, Hydrologic Unit Code (HUC) 03040104.

## 1.5 **Project History and Background**

Based on information depicted by EEP (2009), the Bishop Road Site was purchased in the spring of 2001 from Weyerhaeuser Corporation. As previously mentioned, NCDOT worked with a consultant to complete the original Wetland Mitigation Plan in 2004, a document that described existing and proposed conditions. In 2006, the Project Site was turned over to EEP for project implementation. During this time period, EEP contracted with the same consultant to update the document into a Restoration Plan. Once the document was approved, final design, quantity estimates, construction bidding and implementation proceeded. Construction was completed during the spring of 2009 (EEP, 2009).

Project history and background information is presented in the following four tables. The Final Wetland Restoration Plan (2006) denotes that the Project Site had been managed for timber since the early 1900's and was initially converted from its original vegetative community to pine plantation by removing the canopy vegetation. This was accomplished by first harvesting merchantable timber and then using techniques such as shearing, piling and burning of slash debris. The Project Site has been clear-cut and planted several times. The timber stands across the site were bedded to keep the roots of the planted pine seedlings above the water table.

**Exhibit Table I. Project Restoration Components**  
**Bishop Road Wetland Mitigation Site**  
**SCO Project No. 05-0653802, EEP Project No. 38**

Project Segment or Reach ID	Existing Acres	Restoration Level	Approach	Acreage	Stationing	Buffer Acres	Comments
Non-Riparian Hardwood Flat		R	R	56.3	n/a	n/a	Loblolly pine and road beds removed and replanted with suite of native species
Non-Riparian Hardwood Flat	332.5	n/a	P	332.5	n/a	n/a	-
Coastal Marsh Restoration - Bishop Road		R	R	0.246	n/a	n/a	Road beds removed and replanted with suite of native species
Coastal Marsh Restoration – Silverthorne Road		R	R	0.097	n/a	n/a	Road beds removed and replanted with suite of native species
Coastal Marsh Preservation	184.0	n/a	P	184.0	n/a	n/a	-
Riparian Buffer		R	R	0.171	n/a	n/a	Road beds removed and replanted with suite of native species
Riverine Forested Restoration		R	R	1.0	n/a	n/a	Road beds removed and replanted with suite of native species
Riverine Forested Preservation	61.7	n/a	P	61.7	n/a	n/a	-

R = Restoration  
P = Preservation

**Component Summations**

Restoration Level	Stream (lf)	Riparian Wetland (ac)		Non-Riparian Wetland (ac)	Upland (ac)	Buffer (ac)	Coastal Marsh (ac)
		Riverine	Non-Riverine				
Restoration	n/a	1.0	0	56.3	n/a	0.171	0.343
Enhancement	n/a	0	0	0	n/a	n/a	n/a
Enhancement I	n/a	0	0	0	n/a	n/a	n/a
Enhancement II	n/a	0	0	0	n/a	n/a	n/a
Creation	n/a	0	0	0	n/a	n/a	n/a
Preservation	n/a	61.7		332.5	n/a	n/a	184.0
High Quality Preservation	n/a	0	0	0	n/a	n/a	n/a
High Quality Preservation	n/a	0	0	0	n/a	n/a	n/a
<b>Totals</b>	n/a	62.7	0	338.80	n/a	0.171	184.343

Source: EEP, 2009



<b>Exhibit Table II. Project Activity and Reporting History</b> Bishop Road Wetland Mitigation Site SCO Project No. 05-0653802, EEP Project No. 38		
Activity or Report	Data Collection Complete	Actual Completion or Delivery
Restoration Plan	December 2006	August 2006
Construction	n/a	December 2008
Planting Activities	n/a	January 2009
Mitigation Plan / As-Built (Year 0 Monitoring – Baseline)	February 2009	July 2009
Year 1 Monitoring	November 2009	December 2010
Warranty Planting	n/a	March 2010
Year 2 Monitoring	November 2010	December 2010
Year 3 Monitoring	November 2011	December 2011
Year 4 Monitoring	November 2012	December 2012
Year 5 Monitoring		

<b>Exhibit Table III. Project Contact Table</b> Bishop Road Wetland Mitigation Site SCO Project No. 05-0653802, EEP Project No. 38		
<b>Designer</b> ARCADIS G&M of North Carolina, Inc.	801 Corporate Center Drive Suite 300 Raleigh, NC 27607 Robert Lepsic, 919.854.1282	
<b>Construction Contractor</b> Kris-Grey Construction, Inc.	P.O. Box 499 Jamesville, NC 27846 Mitch Dotson, 252.799.6607 (mobile)	
<b>Planting Contractor</b> Habitat Assessment and Restoration Program, Inc.	9305-D Monroe Road Charlotte, NC 28270 Alan Peoples, 704.841.2841	
<b>Seeding Mix Supplier (Permanent)</b>	Ernst Seeds Meadville, PA 16335 800.873.3321	
<b>Seed Mix Suppliers (Temporary)</b>	Indian Creek Farms Midway, AL 888.307.8773  Evergreen Seed, LLC Rice, VA 23966	
<b>Nursery Stock Suppliers</b>	Mellow Marsh Farms Siler City, NC 919.742.1200  SC Super Tree Nursery Blenheim, SC 843.528.3943	Coastal Plain Conservation Nursery Edenton, NC 252.482.5707  Weyerhaeuser NR Company Atlanta, GA 800.221.4898
<b>Monitoring Performer</b>	Ecological Engineering, LLP 1151 SE Cary Parkway, Suite 101 Cary, North Carolina 27518	
Wetland Monitoring POC	G. Lane Sauls Jr., 919.557.0929	
Vegetation Monitoring POC	G. Lane Sauls Jr., 919.557.0929	

Source: EEP, 2009

<b>Exhibit Table IV. Project Background Table</b>	
<b>Bishop Road Wetland Mitigation Site</b>	
<b>SCO Project No. 05-0653802, EEP Project No. 38</b>	
Project County	Hyde
Drainage Area	n/a
Impervious Cover Estimate	<1%
Stream Order	n/a
Physiographic Region	Outer Coastal Plain
Ecoregion (Griffith and Omernik)	Chesapeake-Pamlico Lowlands and Tidal Marshes
Rosgen Classification of As-built	n/a
Cowardin Classification	n/a
Dominant Soil Types	Acredale, Argent, Hydeland
Reference Site ID	n/a
USGS HUC for Project and Reference	03020104120010
NCDWQ Sub-basin for Project and Reference	03-03-07
Any Portion of any project segment 303d listed?	No
Any portion of any project segment upstream of a 303d listed segment.	No
Reason for 303d listing or stressor	n/a
Percent of project easement fenced	0%

Source: EEP, 2009

## 2.0 Project Condition and Monitoring Results

Precipitation is one of the most critical factors in determining both vegetation and wetland success. During the past several years, Hyde and many other counties across North Carolina have faced below normal precipitation amounts. The year 2012 results denote wetter conditions than those experienced during the past several years. According to the NC Drought Management Advisory Council (2012), Hyde County experienced 15 weeks of abnormally dry and nine weeks of moderate drought through 2012. Last year's results were seven weeks of abnormally dry, four week of moderate drought, five weeks of severe drought and eight weeks of extreme drought conditions. The following chart denotes the drought status and subsequent dates with respect to Hyde County.

<u>Abnormally Dry (DO)</u>	<u>Abnormally Dry (DO)</u>	<u>Moderate Drought (D1)</u>
March 6	May 8	January 3
March 13	May 15	January 10
March 20	May 22	January 17
March 27	May 29	January 24
April 3	October 16	January 31
April 10	October 23	February 7
April 17	May 8	February 14
April 24		February 21
May 1		February 28

Source: NC Drought Management Advisory Council (2012).

### 2.1 Vegetation Assessment

Vegetation at the Project Site was assessed by general visual assessments and counting stems within the nine pre-determined vegetation plots and three additional plots added in 2010. These plots are randomly scattered throughout the Project Site and used to determine the approximate stems per acre in and surrounding the plot location. Their locations are shown on Figure 3. Assessments within each of the plots were completed using methodology prescribed by the CVS and EEP. Level II assessments were completed on ten of the 12 plots. The two remaining plots were assessed using Level III assessment protocol. Appendix A provides the vegetation related data and information including CVS-EEP output tables and photographic comparisons. Specific information regarding the CVS protocol is presented in Section 3.0.

#### 2.1.1 Vegetation Problem Areas

Based on the annual field assessment, several vegetation problem areas exist at the Project Site. These areas are also depicted on Figure 3 and described in the following paragraphs.

For wetland mitigation success, the USACE et. al. (2003) denotes that planted stem counts should be no less than 320 stems per acre after the third year of monitoring and no less than 260 after Year 5. For buffer success, the counts must be no less than 320 planted stems per acre after Year 5. Based on the field data collected during Year 1 monitoring, the annual mean of planted stems at the Project Site was estimated at approximately 273 stems per acre. EEP utilized the planting contractor's one-year warranty and a supplemental planting was conducted across several portions of the Site during early 2010. Once planting was complete, planted stem count estimates were updated during MY 2 activities.

Year 4 monitoring results were lower than MY 3 results for both planted and total stem numbers. The means for planted and total stems were 191 and 2,146 stems per acre as compared with the MY 3 results of 235 and 3,549 stems per acre, respectively. Six of the nine wetland vegetation plots met the five-year threshold amount for planted stems. In addition, Vegetation Plots #24 and #25 were also investigated for percent cover. Neither exhibited any planted stems although Vegetation Plot #24 did exhibit total stem counts of approximately 526 stems per acre. Its overall coverage was estimated at 95 percent, while coverage at Vegetation Plot #25 was estimated at 50 percent. Cover estimates increased 15 and 40 percent, respectively as compared with MY 3 coverage estimates. The absence of planted stems throughout these two areas is likely the result of continuous high water levels during the initial planting and subsequent monitoring years. None of the three buffer plots met the success criteria of 320 planted stems per acre. These plots did not exhibit planted stems; however, did have volunteer species. Total stem counts ranged from 2,034 to 2,760 stems per acre. Exhibit Table V summarizes the vegetation criteria attainment.

Other existing problem areas are associated with exotic invasive vegetation, specifically common reed (*Phragmites australis*). This species is common to Hyde County, especially along roadside and utility rights-of-way, managed impoundments and upper marsh areas. Wind dispersion is the main culprit for the spread of common reed. EEP is currently utilizing a contractor to spray this species during the growing seasons of MY 3, MY 4 and MY 5. Based on the site visit in November, small populations are present, which will be controlled during next year's monitoring period. The current locations of controlled and remaining populations are depicted on Figure 3.

## **2.2 Wetland Assessment**

Wetland areas at the Project Site were assessed by hydrologic data collected and general visual observations. Hydrologic data was collected using a combination of 24 and 40-inch groundwater monitoring wells (or piezometers) that collect daily groundwater elevation levels. These monitoring wells were placed adjacent to the eight of the existing vegetation plots. Four original reference monitoring wells were strategically placed within the Project Site to act as control for existing and functional jurisdictional wetlands. Ongoing wildlife damage has resulted in the removal of two of these wells. The remaining eight monitoring wells document hydrology throughout the areas receiving mitigation credit. Figure 4 depicts all of the associated well locations. For hydrologic success, the restoration plan states that groundwater elevations must be within 12 inches of the ground surface for a consecutive period no less than 5% (approximately 12 days) of the growing season.

All 10 of the monitoring wells met the hydrologic requirements of saturation within 12 inches of the ground surface for a period no less than 5% of the growing season. The growing season at the Project Site is estimated at 230 total days, ranging from March 27 through November 12. Eight wells exceeded the saturation requirements for more than 12.5% of the growing season.

Exhibit Table V summarizes the wetland criteria attainment. Additional information including charts comparing groundwater elevations with respect to precipitation amounts is provided in Appendix B.

### **2.2.1 Wetland Problem Areas**

No wetland problem areas currently exist at the Project Site.

**Exhibit Table V. Wetland Criteria Attainment**

Bishop Road Wetland Mitigation Site

SCO Project No. 05-0653802, EEP Project No. 38

Well ID	Well Hydrology Threshold Met? Percentage?	Tract Mean	Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
MW# 7 (Reference)	Yes 100.0%	29%			
MW# 14 (Reference)	Yes 81.0%	10%			
MW# 17	Yes >12.5%	61%	VP# 17	Yes (364 stems/ac)	61%
MW# 18	Yes 9.5%		VP# 18	Yes (323 stems/ac)	
MW# 19	Yes >12.5%		VP# 19	Yes (485 stems/ac)	
MW# 20	Yes >12.5%		VP# 20	Yes (404 stems/ac)	
MW# 21	Yes >12.5%		VP# 21	Yes (283 stems/ac)	
MW# 22	Yes >12.5%		VP# 22	Yes (404 stems/ac)	
MW# 23	Yes >12.5%	10%	VP# 23	No (40 stems/ac)	10%
MW# 24	Yes >12.5%	29%	VP# 24	No (0 stems/ac)	29%
			VP# 25	No (0 stems/ac)	
			Tarklin Creek	No (0 stems/ac)	<1%
			SW Scranton	No (0 stems/ac)	
			NW Scranton	No (0 stems/ac)	

Notes: Growing Season Length = 230 days  
 12.5% = 29 days  
 5% = 11 days

### 3.0 Methodology

This monitoring report follows methodology consistent with EEP's Content, Format and Data Requirements for EEP Monitoring Reports (Version 1.2, dated 11/16/06), available at EEP's website (<http://www.nceep.net>).

Vegetation assessments were conducted using the CVS-EEP protocol (Version 4.2). As part of this protocol, vegetation is assessed using 100-meter<sup>2</sup> plots, or modules. The scientific method requires that measurements be as unbiased as possible, and that they be repeatable. Plots are designed to achieve both of these objectives; in particular, different people should be able to inventory the same plot and produce similar data (Lee et. al., 2006).

According to Lee et. al. (2006), there are many different goals in recording vegetation, and both time and resources for collecting plot data are extremely variable. To provide appropriate flexibility in project design, the CVS-EEP protocol supports five distinct types of vegetation plot records, which are referred to as levels in recognition of the increasing level of detail and complexity across the sequence. The lower levels require less detail and fewer types of information about both vegetation and environment, and thus are generally sampled with less time and effort (Lee et. al., 2006). Level 1 (Planted Stem Inventory Plots) and Level 2 (Total Woody Stem Inventory Plots) inventories were completed on all nine of the vegetation plots at the Project Site. In addition, Level 3 (Community Occurrence Plots) inventories were conducted on the two marsh vegetation plots.

Level 1 plots are applicable only for restoration areas with planted woody stems. The primary purpose is to determine the pattern of installation of plant material with respect to species, spacing, and density, and to monitor the survival and growth of those installed plants. Level 1 plots are one module in size (Lee et. al., 2006).

Level 2 plots also are designed specifically for restoration areas and represent a superset of information collected for Level 1 plots. In these plots planted woody stems are recorded exactly as for Level 1, but in addition all woody stems resulting from natural regeneration are recorded by size class using separate datasheets. These plots allow an accurate and rapid assessment of the overall trajectory of woody-plant restoration and regeneration on a site. Level 2 plots are one module in size (Lee et. al., 2006).

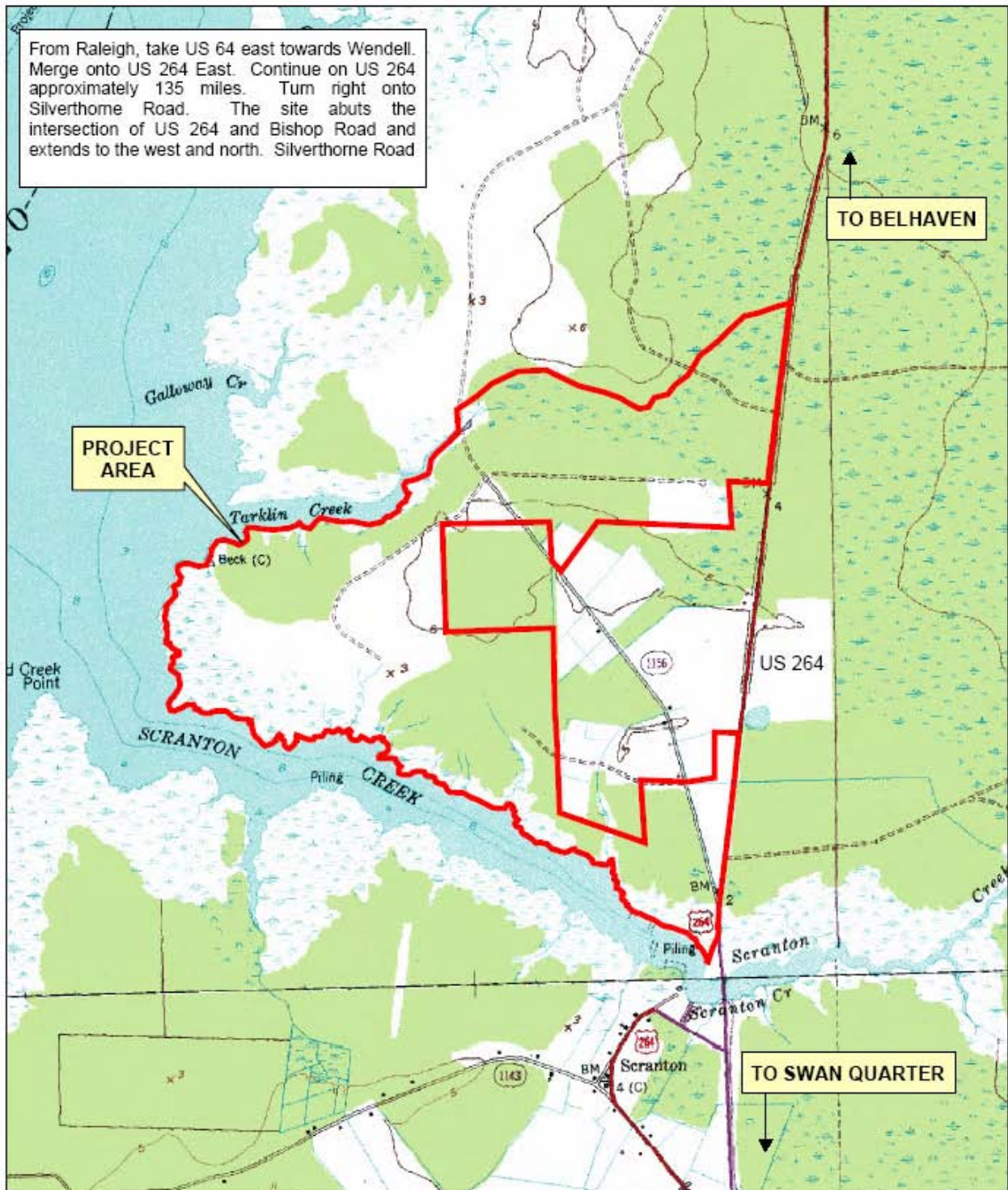
Level 3 plots are used to document the overall abundance and vertical distribution of leaf area cover of the more common species in a plot. Cover is estimated for all plant species exceeding a specified lower level (typically 5% cover); species present but with cover lower than the cut-off may be ignored. The information can also be used to assess vegetation successional status as well as the presence and abundance of undesirable taxa such as invasive exotics. Additional environmental data are collected in Level 3 plots. Optionally, woody stem data required for Level 2 plots (tallies of planted and/or natural woody stems) may be collected for Level 3 plots to allow more accurate assessment of the rate and direction of succession. Level 3 plots are one module in size (Lee et. al., 2006).

Ten Ecotone WM (40-inch) Water Level Monitors record daily groundwater elevations across the Project Site. These wells are downloaded electronically in person approximately three times per year.

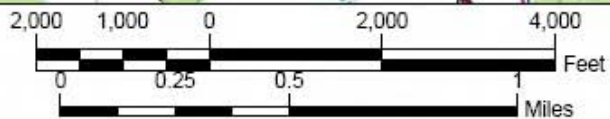
## 4.0 References

- Environmental Laboratory, 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. Prepared for Department of the Army, US Army Corps of Engineers, Washington, DC 20314-1000.
- Lee, M.T., Peet, R.K., Roberts, S.D., and T.R. Wentworth, 2006. CVS-EEP Protocol for Recording Vegetation Version 4.0. Retrieved October 30, 2006, from: <http://www.nceep.net>.
- Miller, K.H., 2009. Bishop Road Wetland Mitigation Site Background Data. Prepared by NCDENR Ecosystem Enhancement Program.
- NC Department of Environment and Natural Resources, Ecosystem Enhancement Program (EEP), 2011. Bishop Road Wetland Restoration Site Monitoring Year 3 (2011), EEP IMS# 38, Hyde County, NC. Prepared by Ecological Engineering, LLP.
- NC Department of Environment and Natural Resources, Ecosystem Enhancement Program (EEP), 2009. Final As-Built and Monitoring Baseline Report, Bishop Road Wetland Restoration, EEP IMS# 38, Hyde County, NC. Prepared by ARCADIS G&M of North Carolina, Inc.
- NC Department of Environment and Natural Resources, Ecosystem Enhancement Program (EEP), 2006. Bishop Road Wetland Restoration Project, Final Restoration Plan Report. Prepared by ARCADIS G&M of North Carolina, Inc.
- NC Drought Management Advisory Council, 2012. Summary of Drought Conditions Throughout North Carolina. Available: <http://www.ncdrought.org>.
- Tiner, R.W., 1993. Field Guide to Coastal Wetland Plants of the Southeastern United States. The University of Massachusetts Press, Amherst, MA.
- US Army Corps of Engineers, US Environmental Protection Agency, NC Wildlife Resources Commission, NC Division of Water Quality, (USACE et.al.), 2003. Stream Mitigation Guidelines.

From Raleigh, take US 64 east towards Wendell. Merge onto US 264 East. Continue on US 264 approximately 135 miles. Turn right onto Silverthorne Road. The site abuts the intersection of US 264 and Bishop Road and extends to the west and north. Silverthorne Road



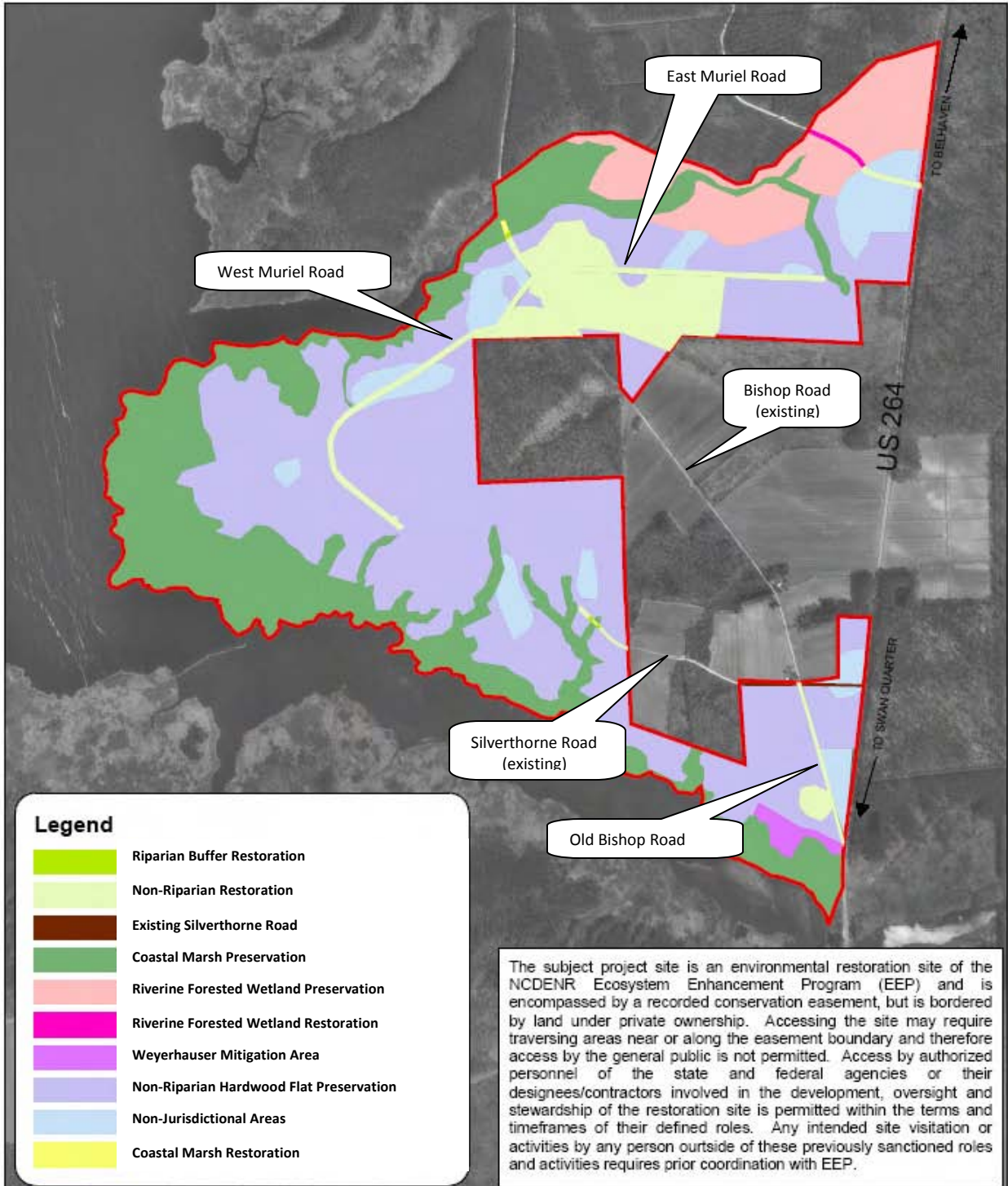
Prepared For:


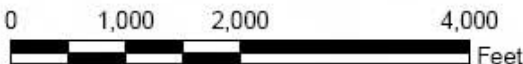




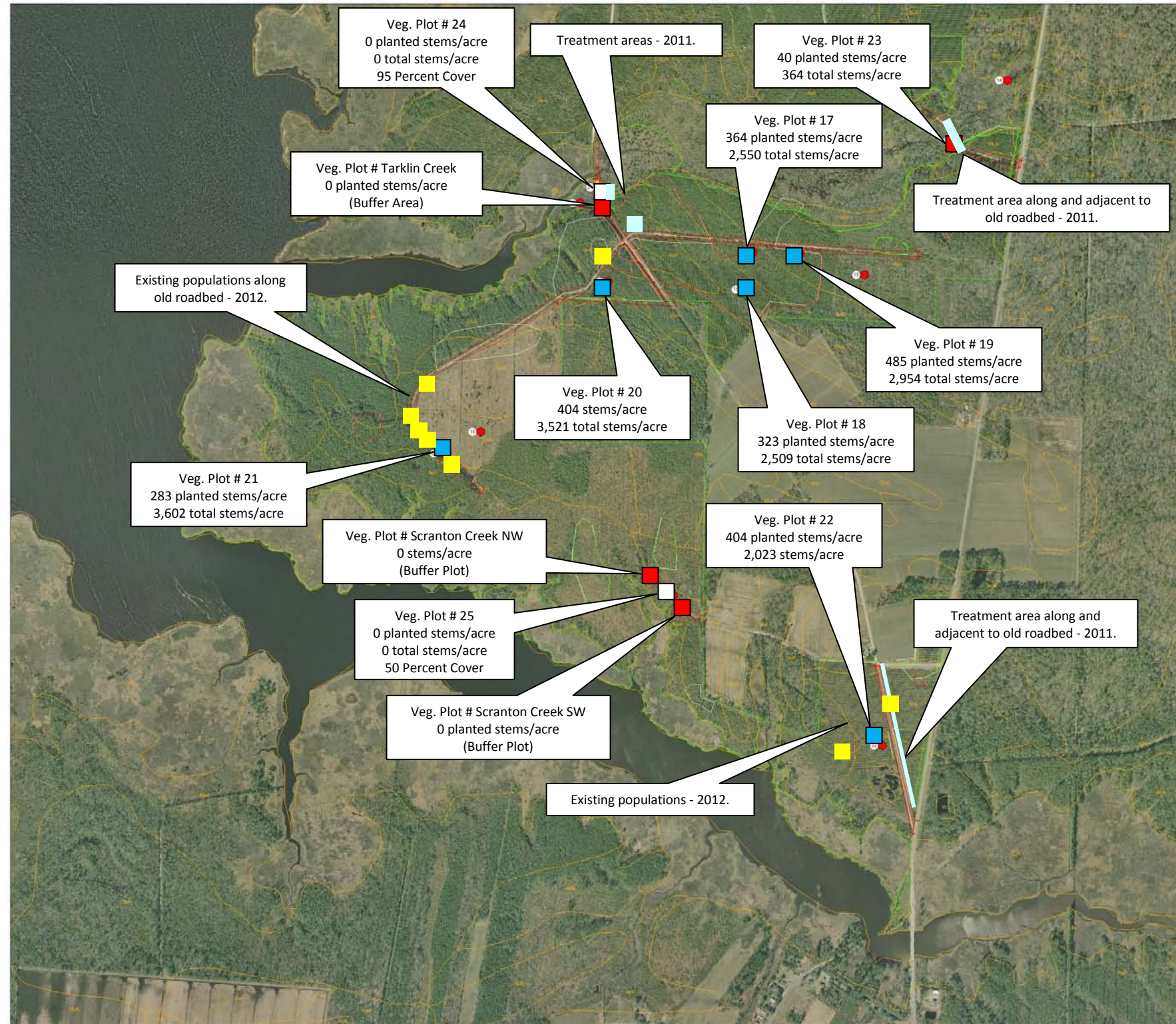
PROJECT SITE VICINITY MAP  
Bishop Road Wetland Mitigation Site  
HYDE COUNTY, NORTH CAROLINA

Figure No.  
1



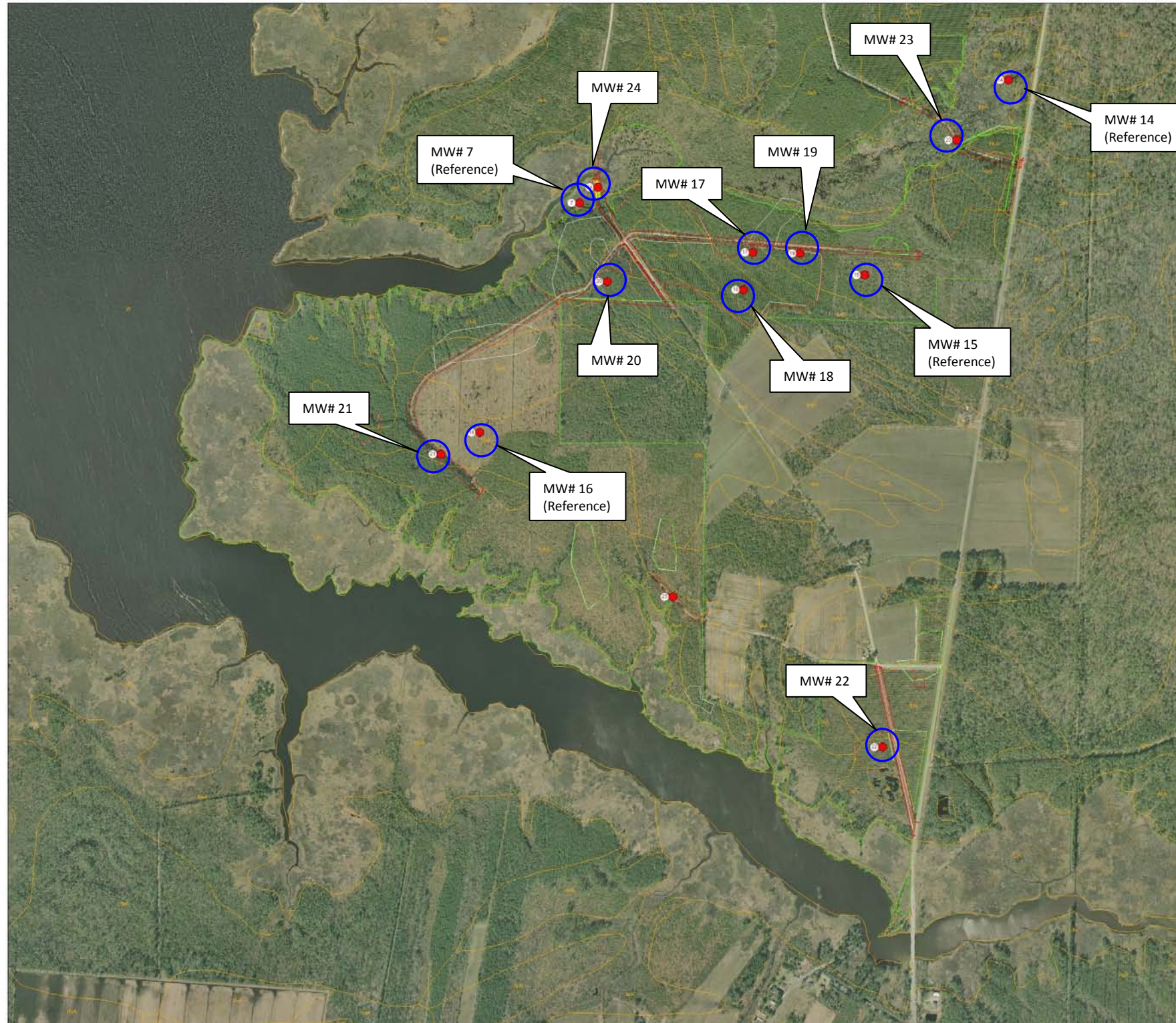


Prepared For: 	 SCALE: 1:18,000	
	<p align="center"> <b>PROJECT ATTRIBUTES</b>          Bishop Road Wetland Mitigation Site          HYDE COUNTY, NORTH CAROLINA  <i>Image: 1993 USGS DOQQ</i> </p>	<p align="center">         Figure No.  <b>2</b> </p>



khmillier 03/11/09





# Bishop Road

Hyde County  
2006 aerial photo  
from CGIA

[ftp://204.211.239.203/outgoing/raster/local\\_imagery/hyde2006/sid/](ftp://204.211.239.203/outgoing/raster/local_imagery/hyde2006/sid/)



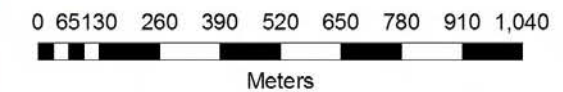
### Key



Monitoring well met  
2012 hydrology  
criteria for mitigation.



Monitoring well did not  
meet 2012 hydrology  
criteria for mitigation  
(Not Applicable)



1 meter = 3.28 feet

khmilller 03/11/09



Wetland Problem Areas Plan View  
Monitoring Year 4 (2012) Assessment

Bishop Road Wetland Mitigation Site, Hyde County, NC  
EEP Project No. 38  
Source: Miller, 2009

Figure  
4

## Appendix A

### Vegetation Raw Data and Annual Photograph Comparisons

**APPENDIX A. Table 1. Vegetation Metadata  
Bishop Road Wetland Mitigation Site (EEP Project No. 38)**

<b>Report Prepared By</b>	Lane Sauls
<b>Date Prepared</b>	11/6/2012 8:47
<b>database name</b>	EcoEng-2012-A-38-BishopRoad-EntryTool-v227.mdb
<b>database location</b>	S:\Projects\50000 State\EEP 50512\50512-003 EEP Bishop Road\CVS DATA
<b>computer name</b>	LANE
<b>file size</b>	62754816
<b>DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----</b>	
<b>Metadata</b>	Description of database file, the report worksheets, and a summary of project(s) and project data.
<b>Proj, planted</b>	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
<b>Proj, total stems</b>	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.
<b>Plots</b>	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
<b>Vigor</b>	Frequency distribution of vigor classes for stems for all plots.
<b>Vigor by Spp</b>	Frequency distribution of vigor classes listed by species.
<b>Damage</b>	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
<b>Damage by Spp</b>	Damage values tallied by type for each species.
<b>Damage by Plot</b>	Damage values tallied by type for each plot.
<b>Planted Stems by Plot and Spp</b>	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
<b>ALL Stems by Plot and spp</b>	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.
<b>PROJECT SUMMARY-----</b>	
<b>Project Code</b>	38
<b>project Name</b>	BISHOP ROAD
<b>Description</b>	Bishop Road Wetland Mitigation Site
<b>River Basin</b>	
<b>length(ft)</b>	
<b>stream-to-edge width (ft)</b>	
<b>area (sq m)</b>	
<b>Required Plots (calculated)</b>	
<b>Sampled Plots</b>	0

APPENDIX A. Table 2. Vigor By Species Bishop Road Wetland Mitigation Site (EEP Project No. 38)								
Species	CommonName	4	3	2	1	0	Missing	Unknown
Aronia arbutifolia	Red Chokeberry			1				
Baccharis halimifolia	eastern baccharis			8				
Ilex glabra	inkberry			1				
Nyssa aquatica	water tupelo						1	
Quercus michauxii	swamp chestnut oak			2				
Quercus pagoda	cherrybark oak		2	1				
Quercus phellos	willow oak		12	3				
Rosa palustris	swamp rose		2	1			2	
Morella cerifera	wax myrtle		13				1	
Ilex opaca	American holly			1			1	
Quercus	oak		5	4			1	
Magnolia virginiana	sweetbay						1	
Myrica	sweetgale						1	
Nyssa	tupelo		1					
Salix	willow							1
<b>TOTAL:</b>	<b>15</b>	<b>15</b>	<b>35</b>	<b>22</b>				<b>9</b>

APPENDIX A. Table 3. Vegetation Damage by Species Bishop Road Wetland Mitigation Site (EEP Project No. 38)						
Species	CommonName	Count of Damage Categories (no damage) - Enter other damage -				
		Deer	Unknown			
Aronia arbutifolia	Red Chokeberry	1				1
Baccharis halimifolia	eastern baccharis	8				8
Ilex glabra	inkberry	1				1
Ilex opaca	American holly	1	1			1
Magnolia virginiana	sweetbay	0	1			
Morella cerifera	wax myrtle	1	13	1		
Myrica	sweetgale	1		1		
Nyssa	tupelo	0	1			
Nyssa aquatica	water tupelo	1		1		
Quercus	oak	4	6		1	3
Quercus michauxii	swamp chestnut oak	2			1	1
Quercus pagoda	cherrybark oak	2	1		2	
Quercus phellos	willow oak	3	12	1	1	1
Rosa palustris	swamp rose	1	4			1
Salix	willow	1		1		
<b>TOTALS:</b>	<b>15</b>	<b>27</b>	<b>39</b>	<b>5</b>	<b>6</b>	<b>16</b>

APPENDIX A. Table 4. Vegetation Damage by Plot Bishop Road Wetland Mitigation Site (EEP Project No. 38)						
Plot	Count of Damage Categories		_ Enter other damage -	Deer	Unknown	
	(no damage)	(no stems on plot)				
E38-1-Gauge17-year:4	0	10				
E38-1-Gauge18-year:4	2	7				2
E38-1-Gauge19-year:4	7	6			5	2
E38-1-Gauge20-year:4	2	10				2
E38-1-Gauge21-year:4	3	4			1	2
E38-1-Gauge22-year:4	8	2				8
E38-1-Gauge23-year:4	5			5		
E38-1-Gauge24-year:4			1			
E38-1-Gauge25-year:4			1			
E38-EEP-NWScranton-year:4			1			
E38-EEP-SWScranton-year:4			1			
E38-EEP-TarklinCreek-year:4			1			
<b>TOTALS:</b>	<b>12</b>	<b>27</b>	<b>39</b>	<b>5</b>	<b>5</b>	<b>6</b>

APPENDIX A. Table 5. Planted Stems by Plot and Species Bishop Road Wetland Mitigation Site (EEP Project No. 38)																
Comment	Species	CommonName	Total Planted Stems													
			# plots	avg# stems	plot E38-1-Gauge17-year:4	plot E38-1-Gauge18-year:4	plot E38-1-Gauge19-year:4	plot E38-1-Gauge20-year:4	plot E38-1-Gauge21-year:4	plot E38-1-Gauge22-year:4	plot E38-1-Gauge23-year:4	plot E38-1-Gauge24-year:4	plot E38-1-Gauge25-year:4	plot E38-EEP-NWScranton-year:4	plot E38-EEP-SWScranton-year:4	plot E38-EEP-TarklinCreek-year:4
	Aronia arbutifolia	Red Chokeberry	1	1	1											
	Baccharis halimifolia	eastern baccharis	8	1	8							8				
	Ilex glabra	inkberry	1	1	1			1								
	Ilex opaca	American holly	1	1	1		1									
	Morella cerifera	wax myrtle	13	5	2.6	3	4	2	2	2						
	Nyssa	tupelo	1	1	1	1										
	Quercus	oak	9	5	1.8	1	2	1	1	4						
	Quercus michauxii	swamp chestnut oak	2	2	1		1	1								
	Quercus pagoda	cherrybark oak	3	1	3			3								
	Quercus phellos	willow oak	15	6	2.5	4		3	4	1	2	1				
	Rosa palustris	swamp rose	3	1	3			3								
	n/a: no stems		0	5								0	0	0	0	0
<b>TOTALS:</b>	<b>1</b>	<b>11</b>	<b>11</b>	<b>57</b>	<b>12</b>	<b>9</b>	<b>8</b>	<b>12</b>	<b>10</b>	<b>7</b>	<b>10</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

Appendix A Table 6. Vegetative Problem Areas Bishop Road Wetland Mitigation Site (EEP Project No. 38)			
Feature/Issue	Station/Range	Probable Cause	Photo #
Vegetation Plot #20	n/a	Drought	VP - 20
Vegetation Plot # 21	n/a	Drought	VP - 21
Vegetation Plot #23	n/a	Inundation	VP -23
Vegetation Plot # 24	n/a	Inundation	VP - 24
Vegetation Plot # 25	n/a	Inundation	VP - 25
Vegetation Plot # Scranton Creek SE	n/a	Drought	VP - Scranton SE
Vegetation Plot # Scranton Creek SW	n/a	Drought	VP - Scranton SW
Vegetation Plot # Tarklin Creek	n/a	Drought	VP - Tarklin Creek
<i>Phragmites australis</i>	n/a	Invasive Species	n/a





**Bishop Road Wetland Mitigation Site Vegetation Plot Photograph Summary**

**Photograph  
Information**

**February 12, 2009 Baseline**

**January 2010 Monitoring Year 1**

**July 2010 Monitoring Year 2**

**July 2011 Monitoring Year 3**

**July 2012 Monitoring Year 4**

Photo #  
VP-17 Facing  
Southwest

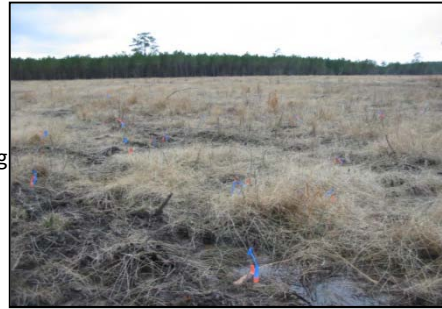


Photo #  
VP-18 Facing  
Northeast



Photo #  
VP-19 Facing  
Southwest



Photo #  
VP-20 Facing  
East



Photo #  
VP-21 Facing  
West



Photograph  
Information

February 12, 2009 Baseline

January 2010 Monitoring Year 1

July 2010 Monitoring Year 2

July 2011 Monitoring Year 3

July 2012 Monitoring Year 4

Photo #  
VP-22 Facing  
West



Photo #  
VP-23 Facing  
North



Photo #  
VP-24 Facing  
North



Photo #  
VP-25 Facing  
North



Photo #  
Scranton  
NW Facing  
Northwest



**Photograph  
Information**

**February 12, 2009 Baseline**

**January 2010 Monitoring Year 1**

**July 2010 Monitoring Year 2**

**July 2011 Monitoring Year 3**

**July 2012 Monitoring Year 4**

Photo #  
Scranton SE  
Facing  
Northwest



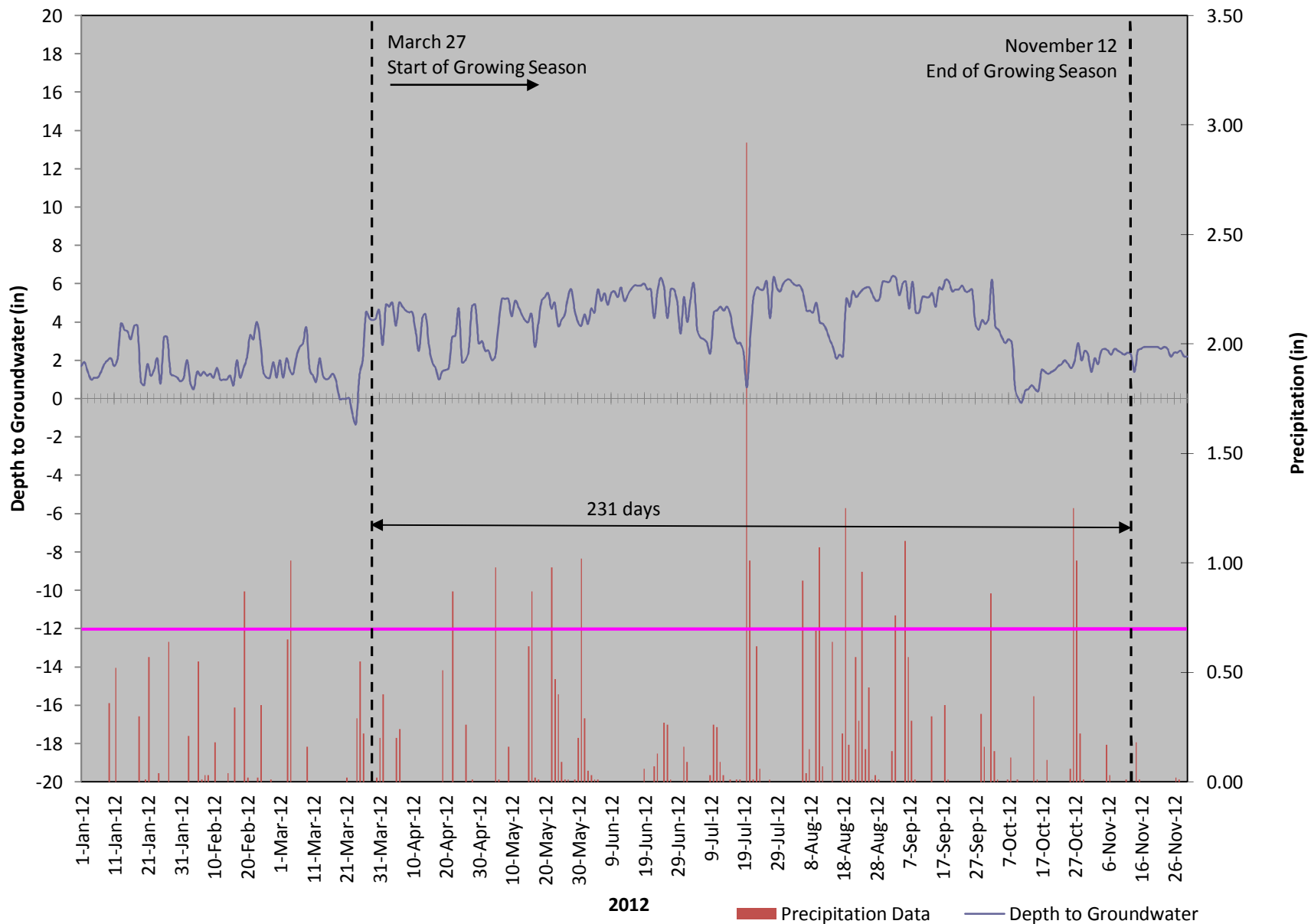
Photo #  
Tarklin  
Creek S  
Facing South



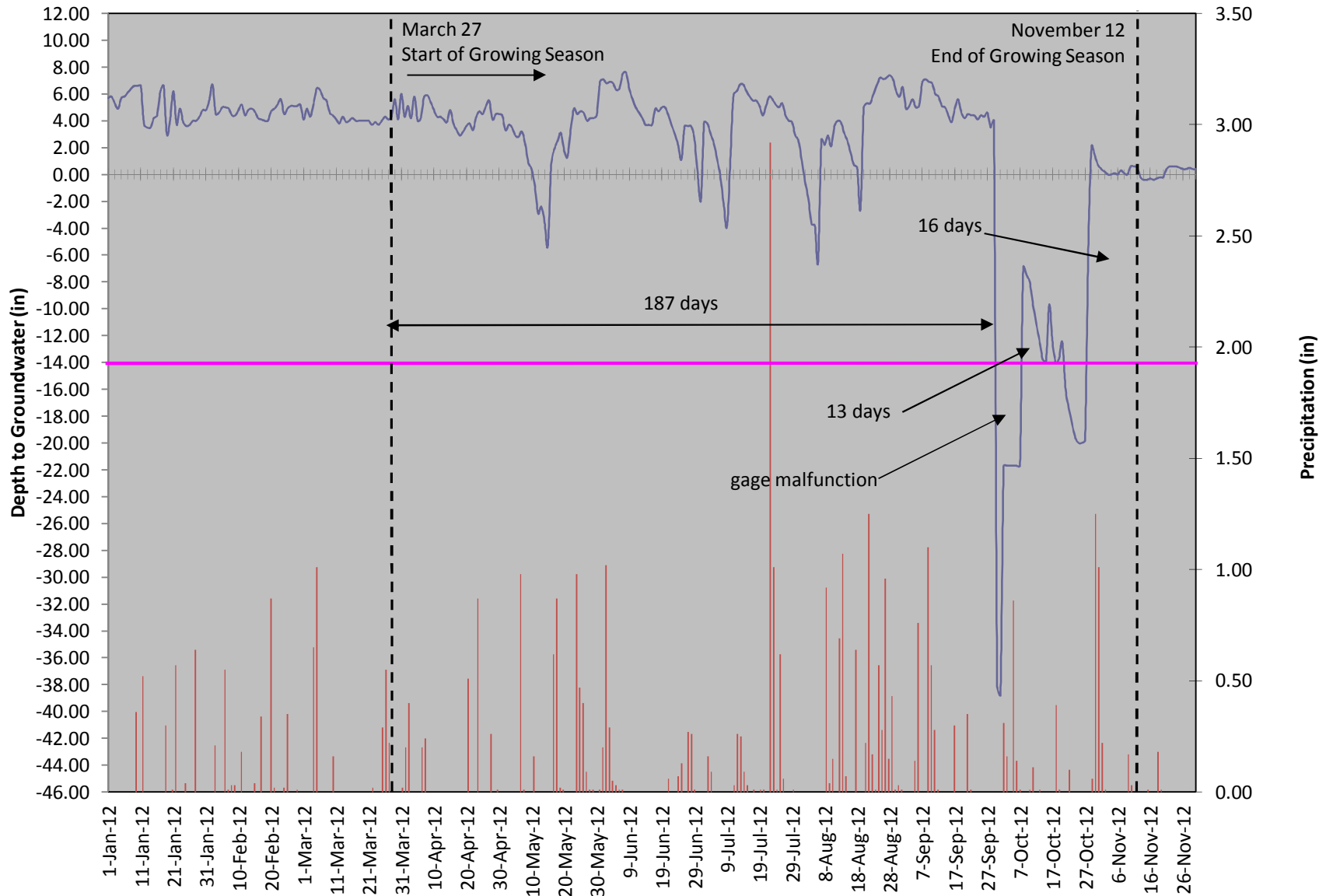
## **Appendix B**

### **Wetland Raw Data**

### Monitoring Well #7 (Reference) 40" Groundwater



### Monitoring Well #14 (Reference) 40" Groundwater



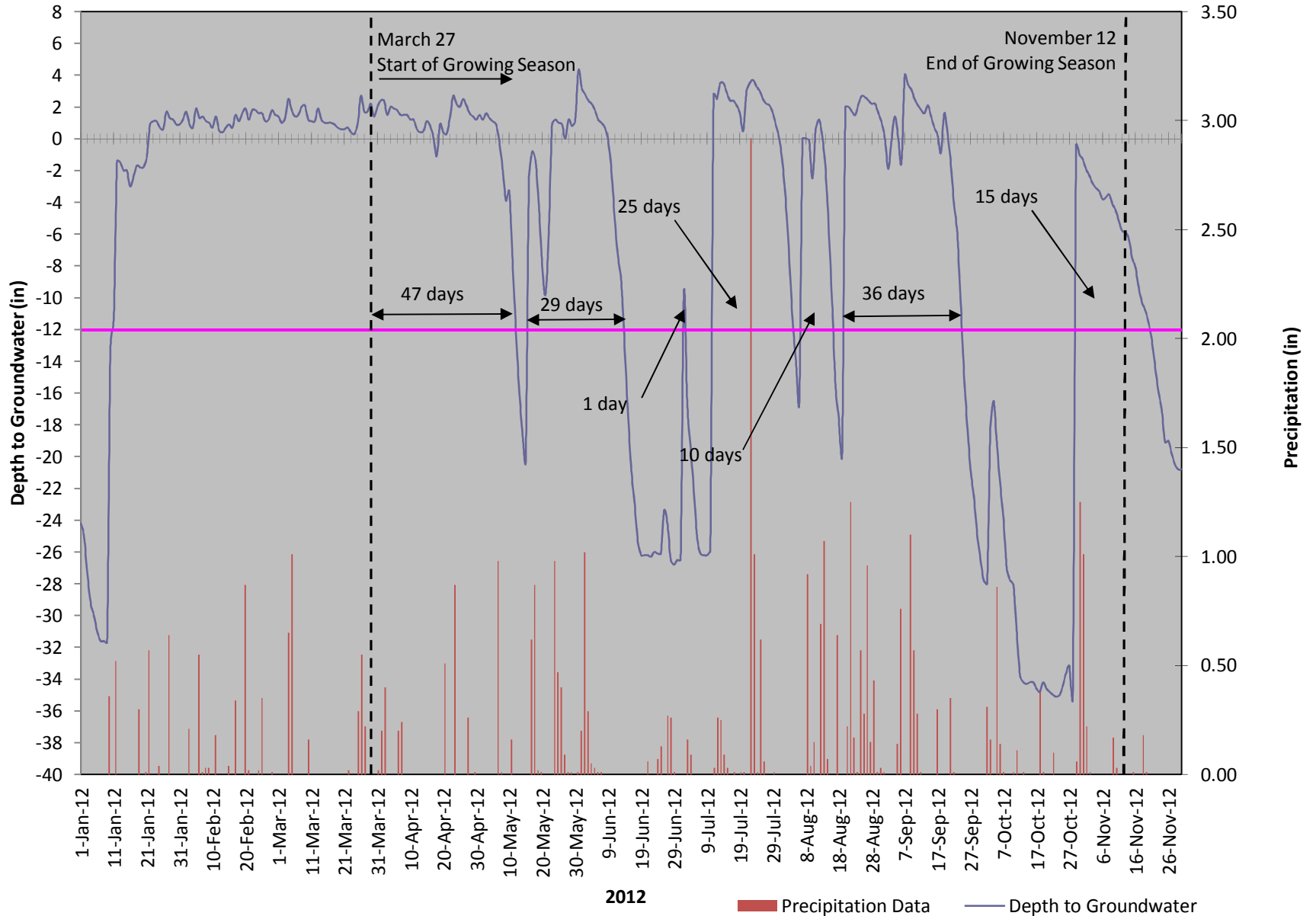
Note: Calibration point is 2 inches above ground surface

2012

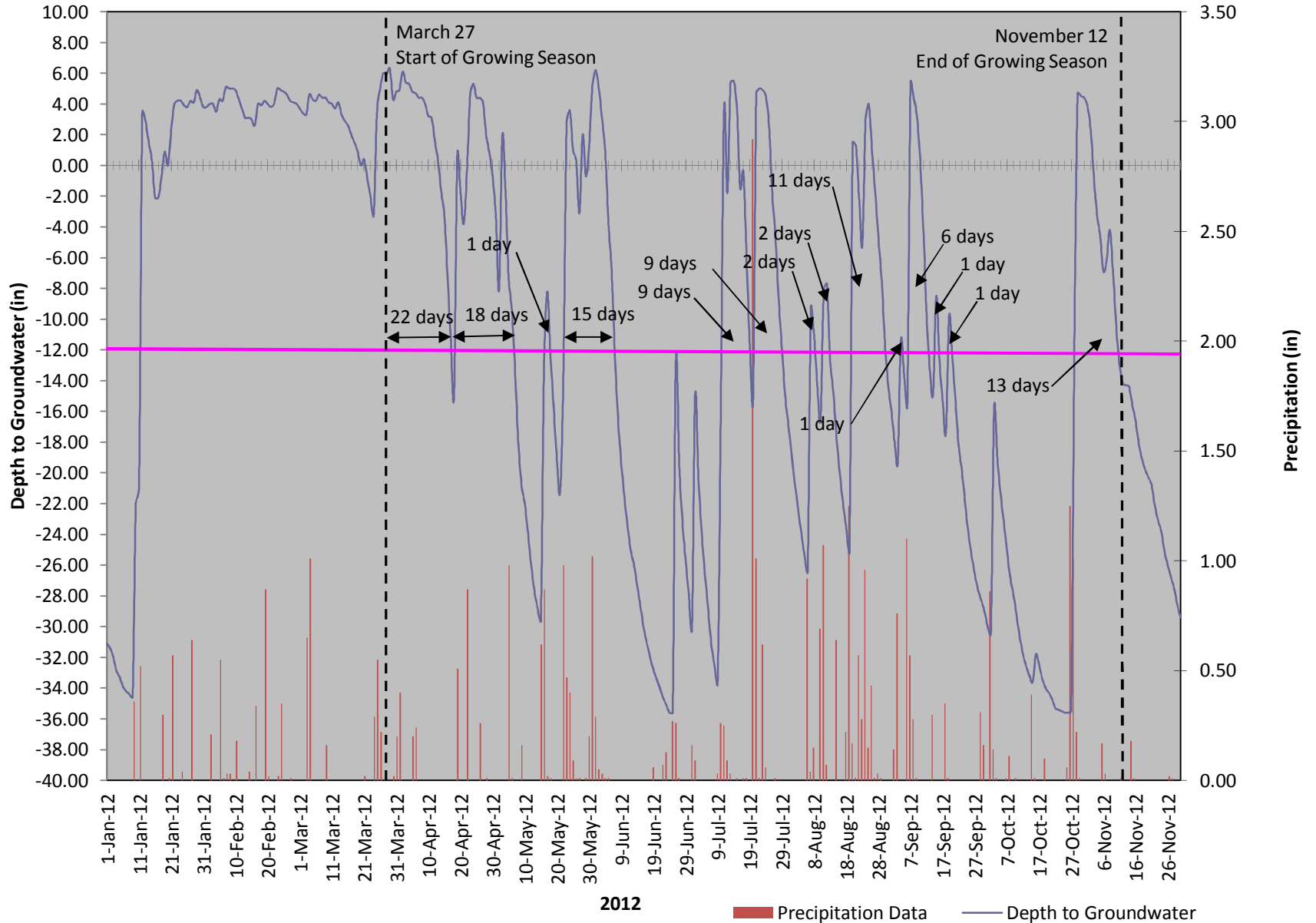
■ Precipitation Data

— Depth to Groundwater

### Monitoring Well #17 40" Groundwater

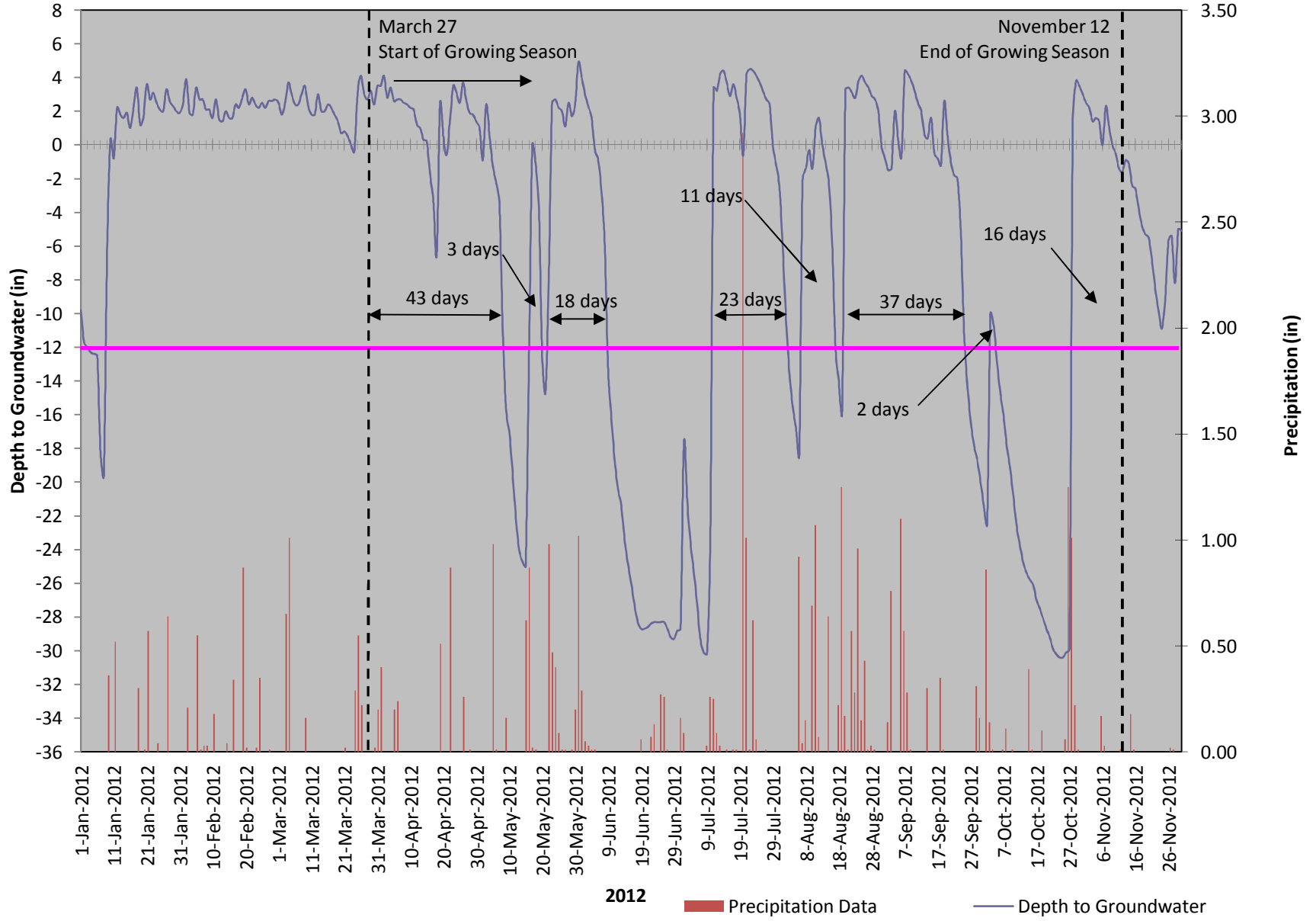


### Monitoring Well #18 40" Groundwater

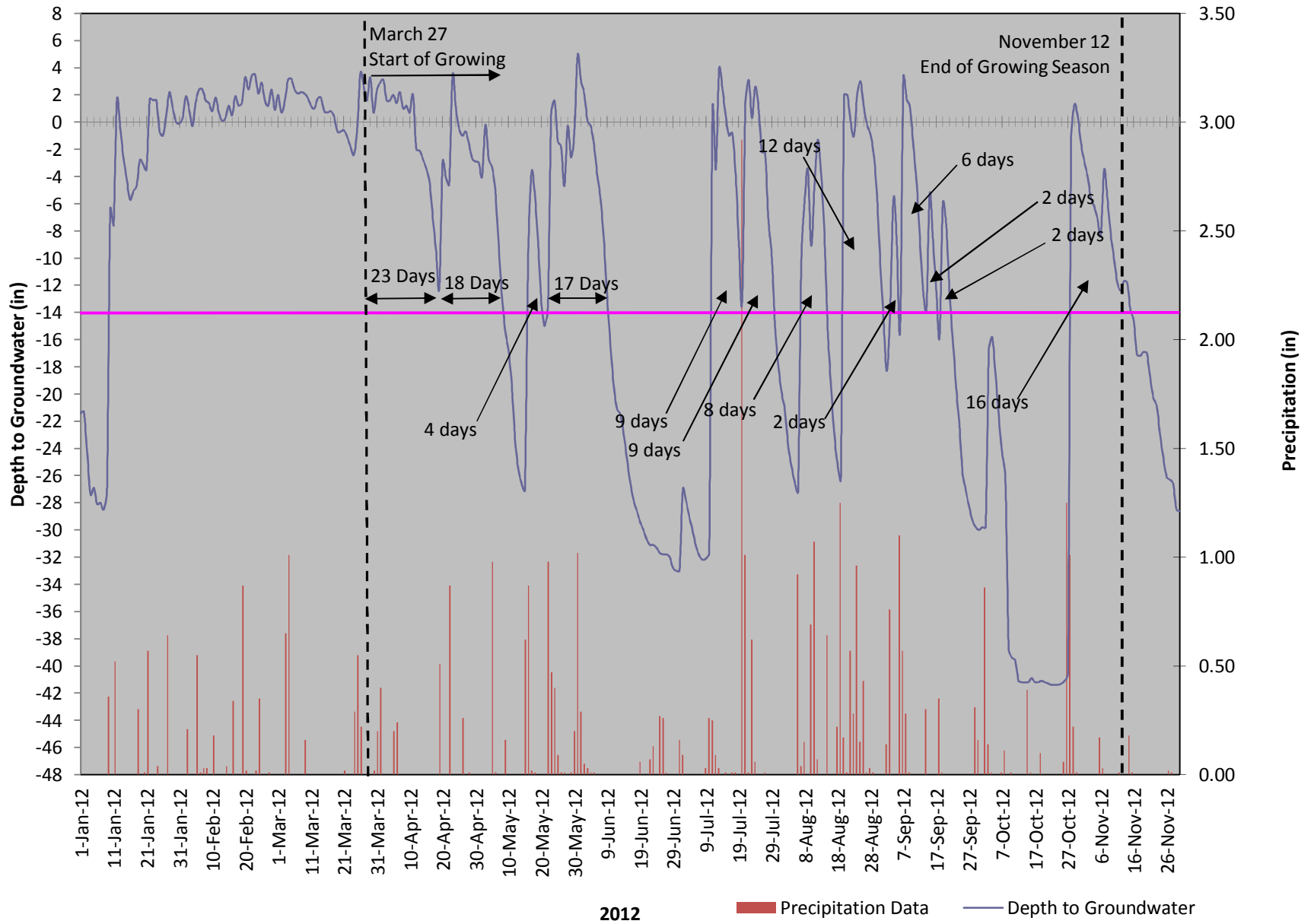




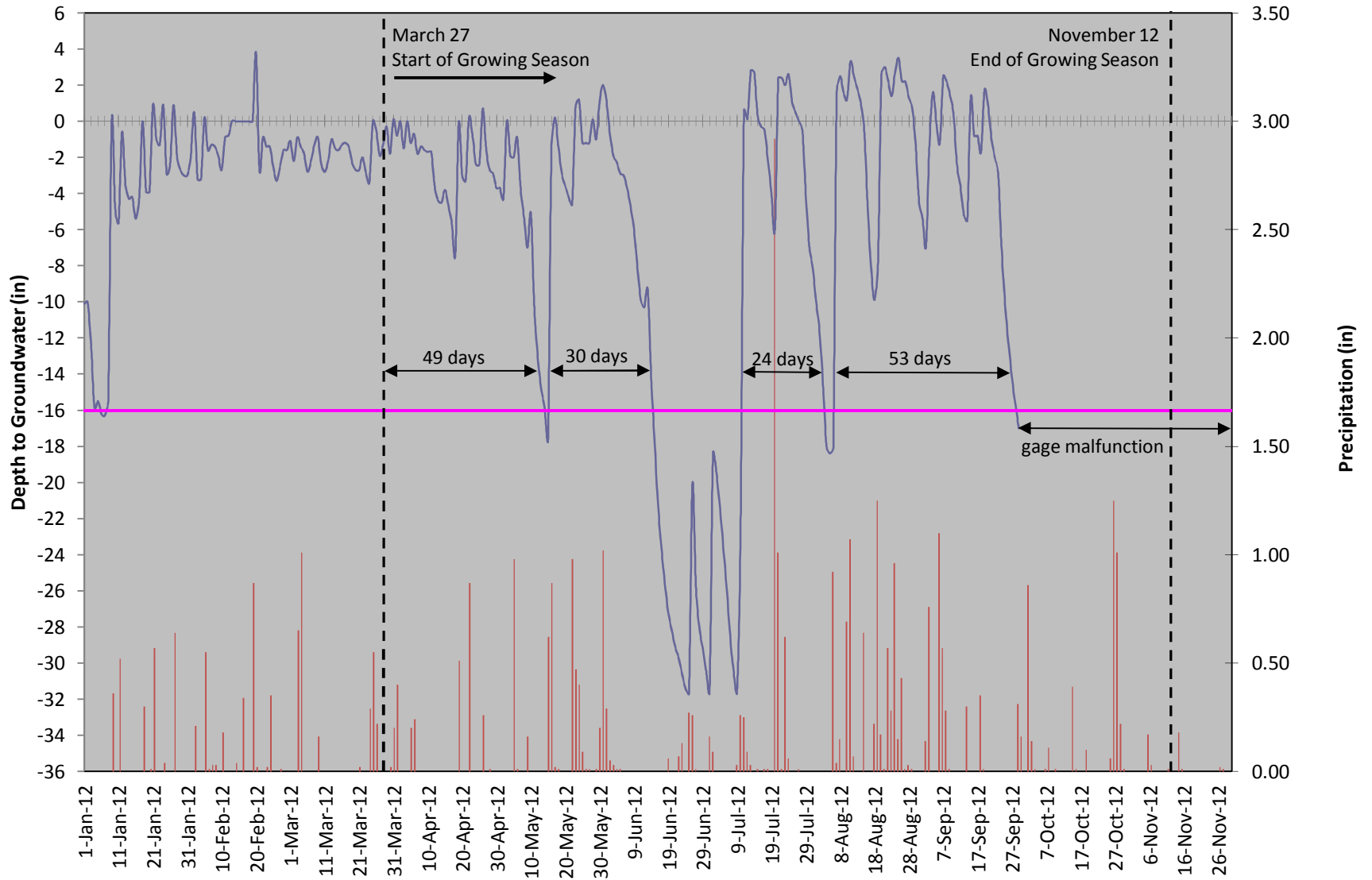
### Monitoring Well #19 40" Groundwater



### Monitoring Well #20 40" Groundwater



### Monitoring Well #21 40" Groundwater



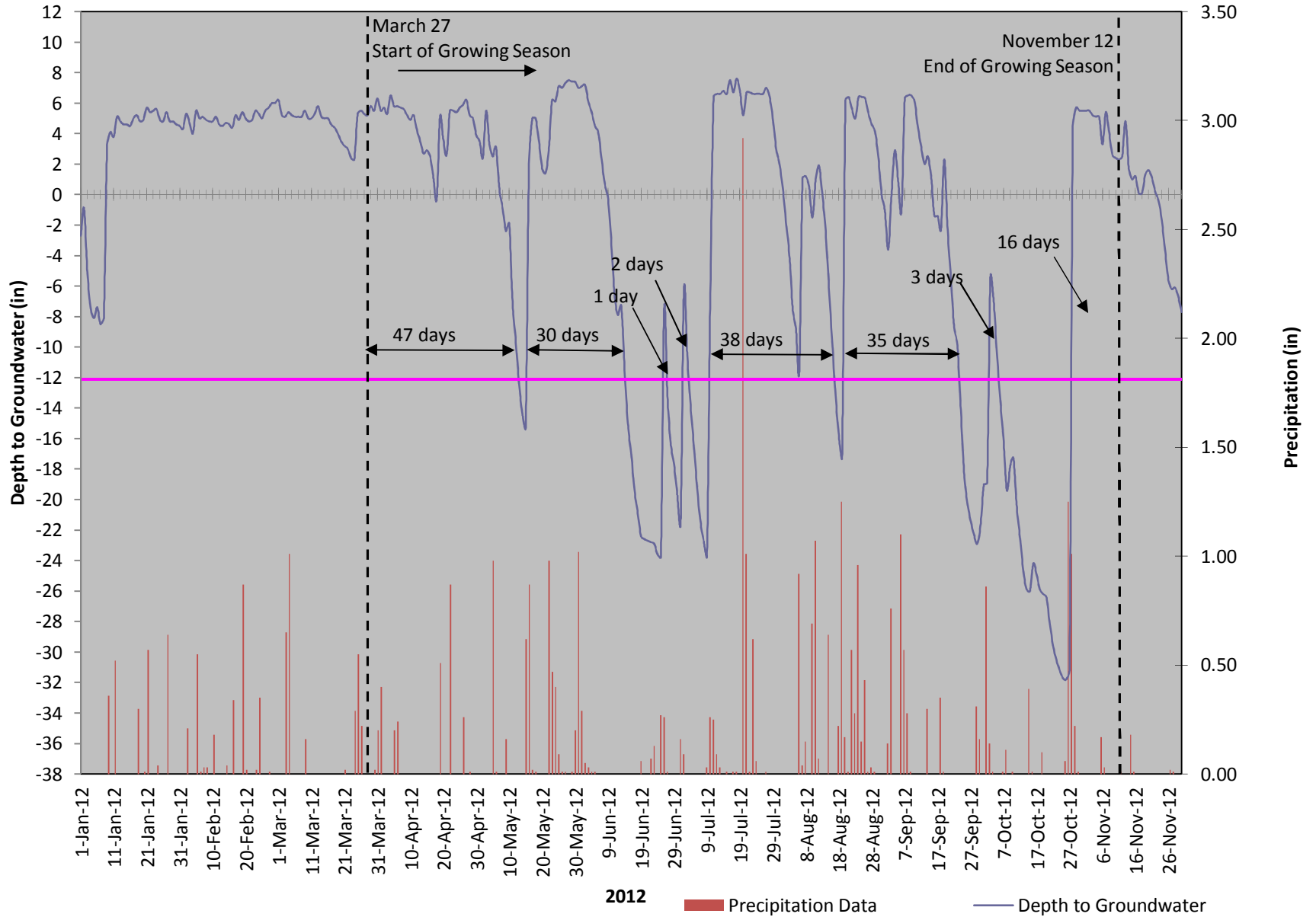
Note: Calibration point is 4 inches above ground surface

2012

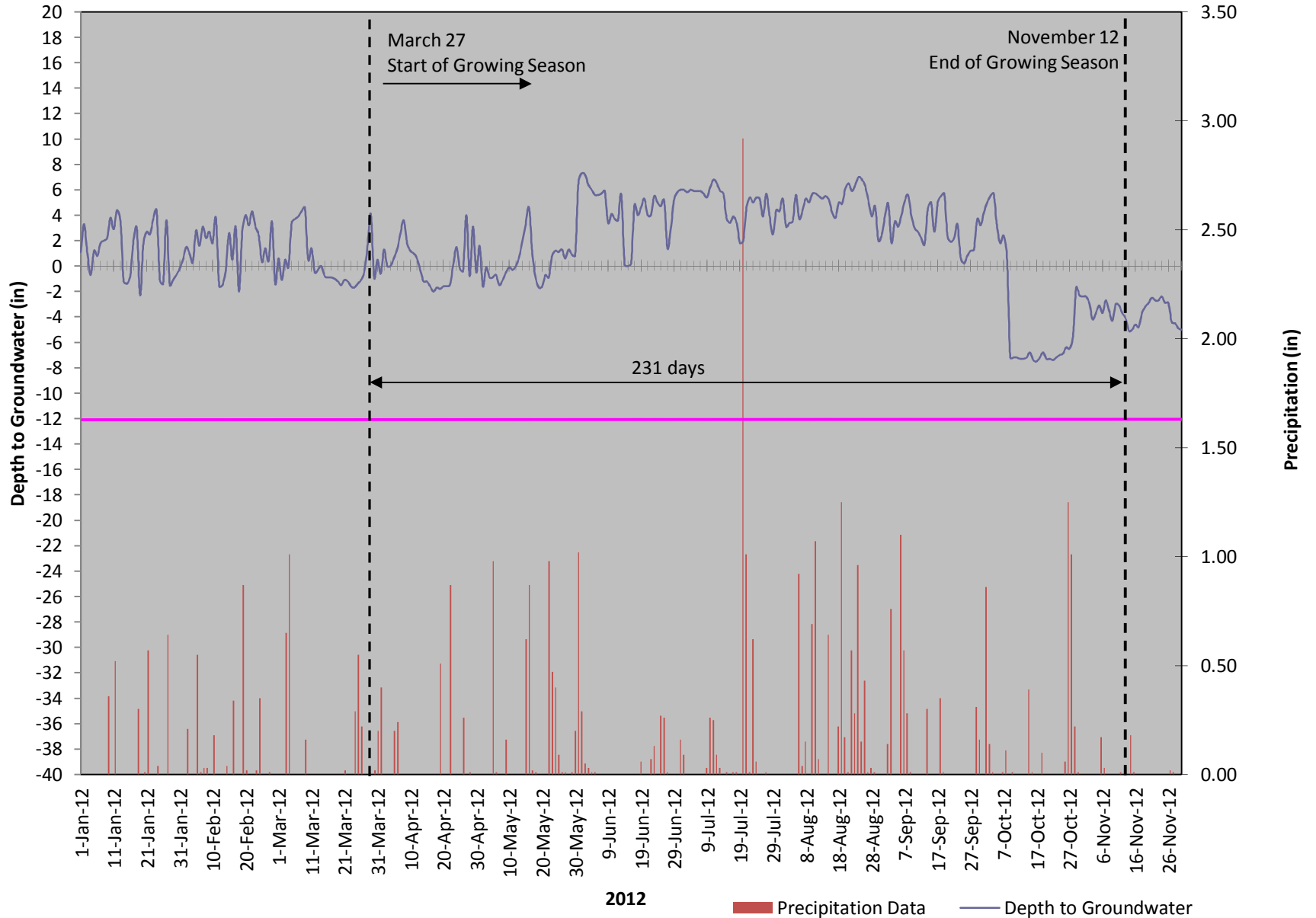
■ Precipitation Data

— Depth to Groundwater

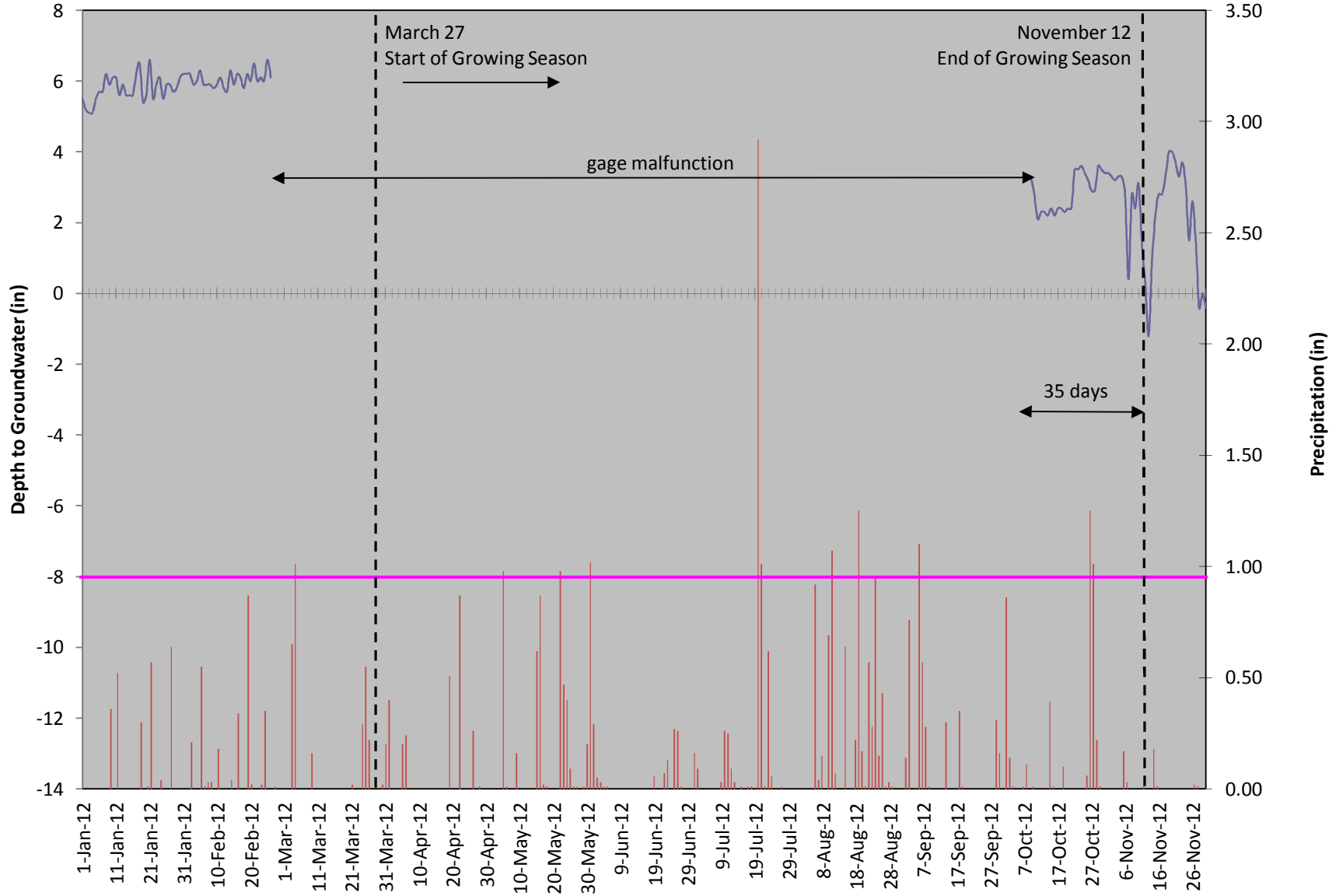
### Monitoring Well #22 40" Groundwater



### Monitoring Well #23 40" Groundwater



### Monitoring Well #24 40" Groundwater



Note: Well is reading 4 inches above normal

2012

■ Precipitation Data    — Depth to Groundwater