Bishop Road Wetland Mitigation Site
Monitoring Year 1 (2009)

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

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FINAL Monitoring Report

December 2010

Prepared by:

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This document is based on the NCDENR Ecosystem Enhancement Program's Monitoring Report Submission Template Version 1.2 (dated 11/16/06) in the Project Implementation Manual.

Table of Contents

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 on-going mitigation needs throughout North Carolina. The Bishop Road Site was purchased in the spring of 2001 from Weyerhauser Corporation. According to Weyerhauser, this and many nearby tracts were being managed for silvicultural uses. 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 the NC Department of Environment and Natural Resources, Ecosystem Enhancement Program (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.

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. The downloading of data was to occur approximately three times per year. Additional services included well maintenance and replacement, 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.

Vegetation Assessment

The Year 1 vegetation monitoring effort was performed by determining density and survival of planted species, consistent with prescribed Carolina Vegetation Survey (CVS) protocols. Nine 100-meter^2 plot locations were assessed. Vegetation success criteria is based on a minimum survival of 320 stems per acre of planted species through Year 3 and 260 stems per acre at the end of Year 5. Volunteer woody vegetation was not included in the survivability calculations. Based on the Year 1 surveys, the mean stem count for all of the plots combined totaled 301 stems per acre. Three plots failed to meet the 320-count threshold. Five plots were slightly above the threshold and one exceeded the threshold by several hundred planted stems per acre. Supplemental planting will be implemented as part of the construction warranty during 2010.

Wetland Assessment

Wetland assessments associated with the Year 1 monitoring effort were performed by collecting groundwater hydrology via monitoring wells that record daily groundwater elevations. Based on the results, a total of 11 wells met the criteria established for wetland hydrology. Four of these were reference wells. Only one well missed the criteria based on consecutive days.

1.0 Project Background

1.1 Project Objectives

Based on information provided in the Bishop Road Wetland Restoration Final As-Built and Monitoring Baseline Report (EEP, 2009), the project related goals were to restore site hydrology, restore natural diverse wetland communities and protect the Project Site from vehicle access, logging or development. These goals were and will be accomplished by the following objectives:

- Remove earthen roads and fill roadside drainage ditches;
- Remove bedding rows in selected areas and replant areas to establish natural plant communities, coastal marshes and forested wetlands; and,
- Purchase property fee simple, put under conservation in perpetuity and install 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^2 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 (DCM). 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 ±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 regarded 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 or structure to allow passage of water under Silverthorne Road at this location. As a result, the small slough upstream of Silverthorne Road was disconnected 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 ±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).

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 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 averaged around 1.5 feet. The depth of the adjacent ditches averaged approximately 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 ± 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.

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 Weyerhauser Corporation. According to Weyerhauser, this and many nearby tracts were being managed for silvicultural uses. The NC Department of Transportation (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 the NC Department of Environment and Natural Resources, Ecosystem Enhancement Program (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							
Bishop Road		R	R	0.246	n/a	n/a	Road beds removed and replanted with suite of native species
Silverthorne		R	R	0.097	n/a	n/a	Road beds removed and replanted with suite of native species
Coastal Marsh	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		R	R	1.0	n/a	n/a	Road beds removed and replanted with suite of native species
Riverine Forested	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	0	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
Totals	n/a	62.7	0	388.8	n/a	0.171	184.343

Source: EEP, 2009

Exhibit Table II. Project Activity and Reporting History 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
Year 2 Monitoring		
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		

Exhibit Table III. Project Contact Table Bishop Road Wetland Mitigation Site SCO Project No. 05-0653802, EEP Project No. 38	
Designer ARCADIS G&M of North Carolina, Inc.	801 Corporate Center Drive Suite 300 Raleigh, NC 27607 Robert Lepsic, 919.854.1282
Construction Contractor Kris-Grey Construction, Inc.	P.O. Box 499 Jamesville, NC 27846 Mitch Dotson, 252.799.6607 (mobile)
Planting Contractor Habitat Assessment and Restoration Program, Inc.	9305-D Monroe Road Charlotte, NC 28270 Alan Peoples, 704.841.2841
Seeding Mix Supplier (Permanent)	Ernst Seeds Meadville, PA 16335 800.873.3321
Seed Mix Suppliers (Temporary)	Indian Creek Farms Midway, AL 888.307.8773 Evergreen Seed, LLC Rice, VA 23966
Nursery Stock Suppliers	Mellow Marsh Farms Siler City, NC 919.742.1200 Coastal Plain Conservation Nursery Edenton, NC 252.482.5707 South Carolina Super Tree Nursery Blenheim, SC 843.528.3943 Weyerhaeuser NR Company Atlanta, GA 800.221.4898
Monitoring Performer	Ecological Engineering, LLP 128 Raleigh Street Holly Springs, NC 27540
Wetland Monitoring POC	G. Lane Sauls Jr., 919.557.0929
Vegetation Monitoring POC	G. Lane Sauls Jr., 919.557.0929

Exhibit Table IV. Project Background Table Bishop Road Wetland Mitigation Site SCO Project No. 05-0653802, EEP Project No. 38	
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	030401020100
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

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. 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 seven of the nine plots. The two remaining plots were assessed using Level III assessment protocols. 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.

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. Based on the field data collected during Year 1 monitoring, the annual mean of planted stems at the Project Site is approximately 301 stems per acre. Three of the nine vegetation plots did not meet the three-year threshold amount. Of the three plots, one (VP# 25) plot did not exhibit any living planted stems. The other two plots (VP# 21 and VP#24) exhibited stem counts less than 300 stems per acre. Only one plot (VP#23) was well above the threshold at approximately 526 stems per acre. The remaining five plots met the threshold, though stem counts were barely above the three-year recommended count. This unfortunately does not leave room for any additional mortality over the next two monitoring seasons. Exhibit Table V summarizes the vegetation criteria attainment.

In January 2010, EEP personnel met with the planting contractor to discuss supplemental plantings throughout the Project Site. The result of the meeting was that supplemental planting will occur and stem counts will be updated during Year 2 monitoring activities.

The other problem area was denoted along Old Bishop Road and the area immediately to the west. Common reed (*Phragmites australis*) is present. This invasive species has a tendency to outcompete native vegetation in wet areas. Controlled burning is the preferred method to control this species.

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 40-inch groundwater monitoring wells (or piezometers) that collect daily groundwater elevation levels. These monitoring wells were placed adjacent to the vegetation plots, with exception of Vegetation Plot# 25 which does not exhibit a well. Four reference monitoring wells were strategically placed within the Project Site to act as control for existing and functional jurisdictional wetlands. These monitoring wells are numbered (MW# 7, 14, 15 and 16). The remaining eight monitoring wells will document hydrology throughout the areas receiving mitigation credit. Figure 4 shows the locations of each of the monitoring wells.

2.2.1 Wetland Problem Areas

One wetland problem area was observed in association with Monitoring Well# 19. This area failed to meet the hydrologic requirement of saturation within 12 inches of the ground surface for a period no less than 12.5% of the growing season. According to EEP (2009), the growing season at the Project Site is estimated at 230 total days, ranging from March 27 through November 12. The number of consecutive days required for hydrologic success is 29.

Monitoring Well# 19 exhibited saturated conditions within 12 inches of the ground surface a total of 106 days; however, the longest consecutive period lasted only 20 days. Although the well experienced saturation for nearly 37 percent of the growing season, it did not meet the hydrologic threshold.

Monitoring Well# 23 met the hydrologic criteria necessary to meet the mitigation thresholds; however, it was first destroyed by a bear in its entirety before a significant portion of the growing season data could be downloaded. A new well was installed near its original location during October 2009 and the well successfully recorded hydrology through the end 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.

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?	Tract Mean	Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
MW# 7 (Reference)	Yes	29%			
MW# 14 (Reference)	Yes	10%			
MW# 15 (Reference)	Yes	61%			
MW# 16 (Reference)	Yes				
MW# 17	Yes	61%	VP# 17	Yes	61%
MW# 18	Yes		VP# 18	Yes	
MW# 19	No		VP# 19	Yes	
MW# 20	Yes		VP# 20	Yes	
MW# 21	Yes		VP# 21	No	
MW# 22	Yes		VP# 22	Yes	
MW# 23	Yes*	10%	VP# 23	Yes	10%
MW# 24	Yes	29%	VP# 24	No	29%
			VP# 25	No	

Notes: * MW# 23 lost all hydrologic data covering two-thirds of the growing season period due to bear attack. A new well was installed on October 23, 2009.
Growing Season Length = 230 days
12.5% = 29 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^2 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 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 collected meets the Ecological Society of America (ESA) guidelines and Federal Geographic Data Committee (FGDC) standards for plots used to classify vegetation to an association within the US National Vegetation Classification (NVC). 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).

Twelve 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.

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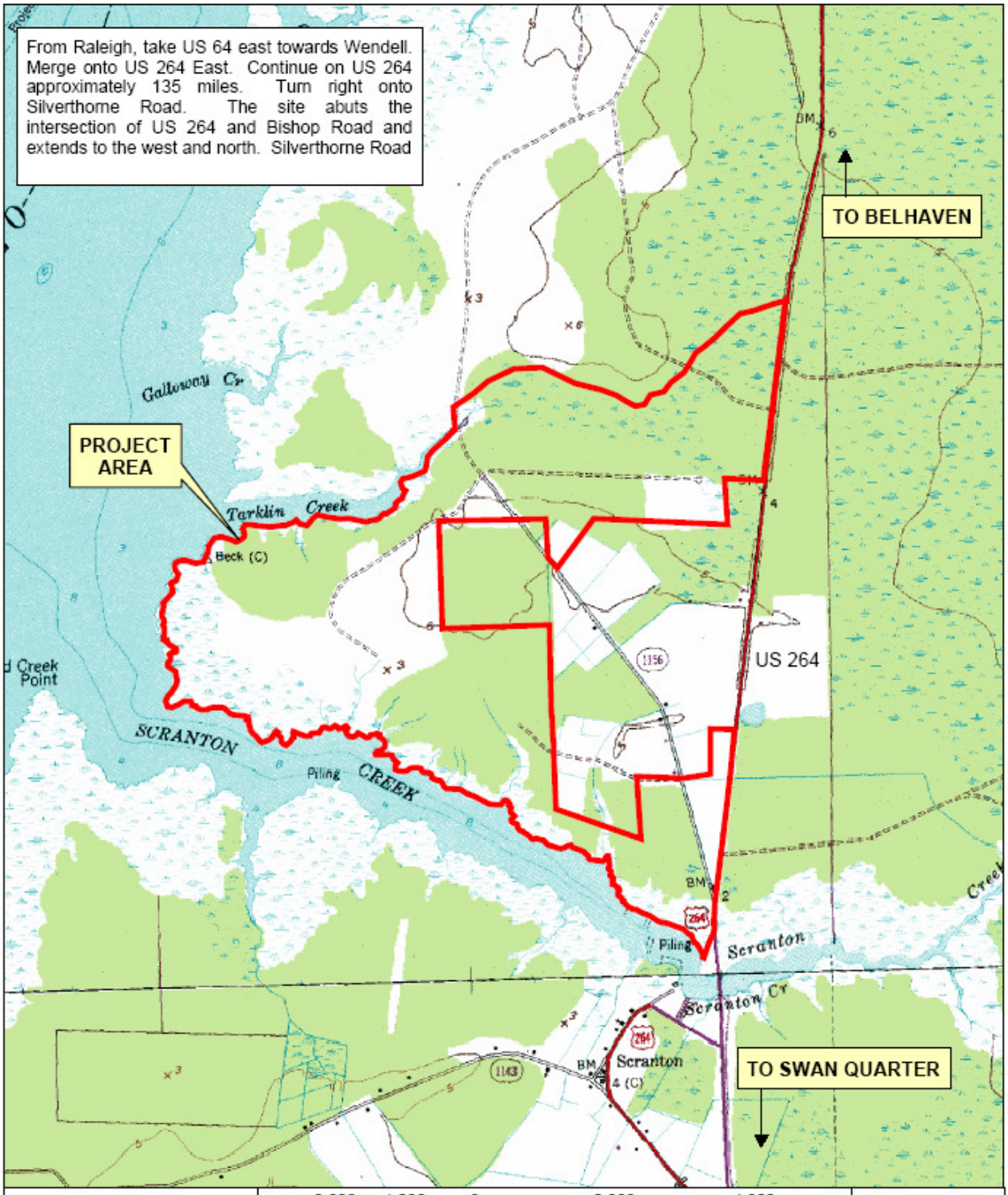
Tiner, R.W., 1993. Field Guide to Coastal Wetland Plants of the Southeastern United States. The University of Massachusetts Press, Amherst, MA.

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.



Prepared For:

Ecosystem Enhancement Program

2,000 1,000 0 2,000 4,000 Feet

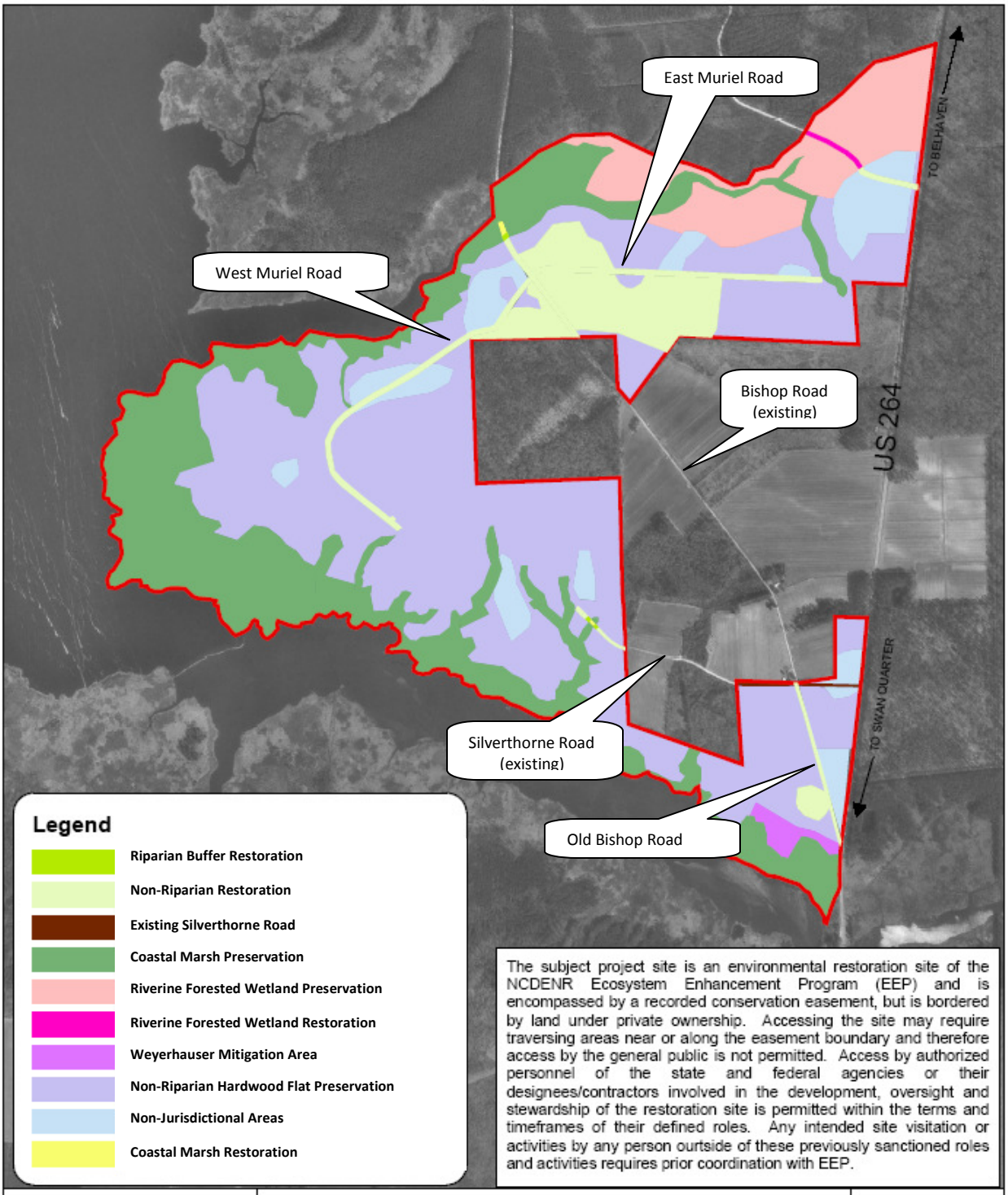
0 0.25 0.5 1 Miles

SCALE: 1:24,000

N W E S

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

Figure No.
1



The subject project site is an environmental restoration site of the NCDENR Ecosystem Enhancement Program (EEP) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access by the general public is not permitted. Access by authorized personnel of the state and federal agencies or their designees/contractors involved in the development, oversight and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitation or activities by any person ourtside of these previously sanctioned roles and activities requires prior coordination with EEP.

Prepared For:

Ecosystem Enhancement Program

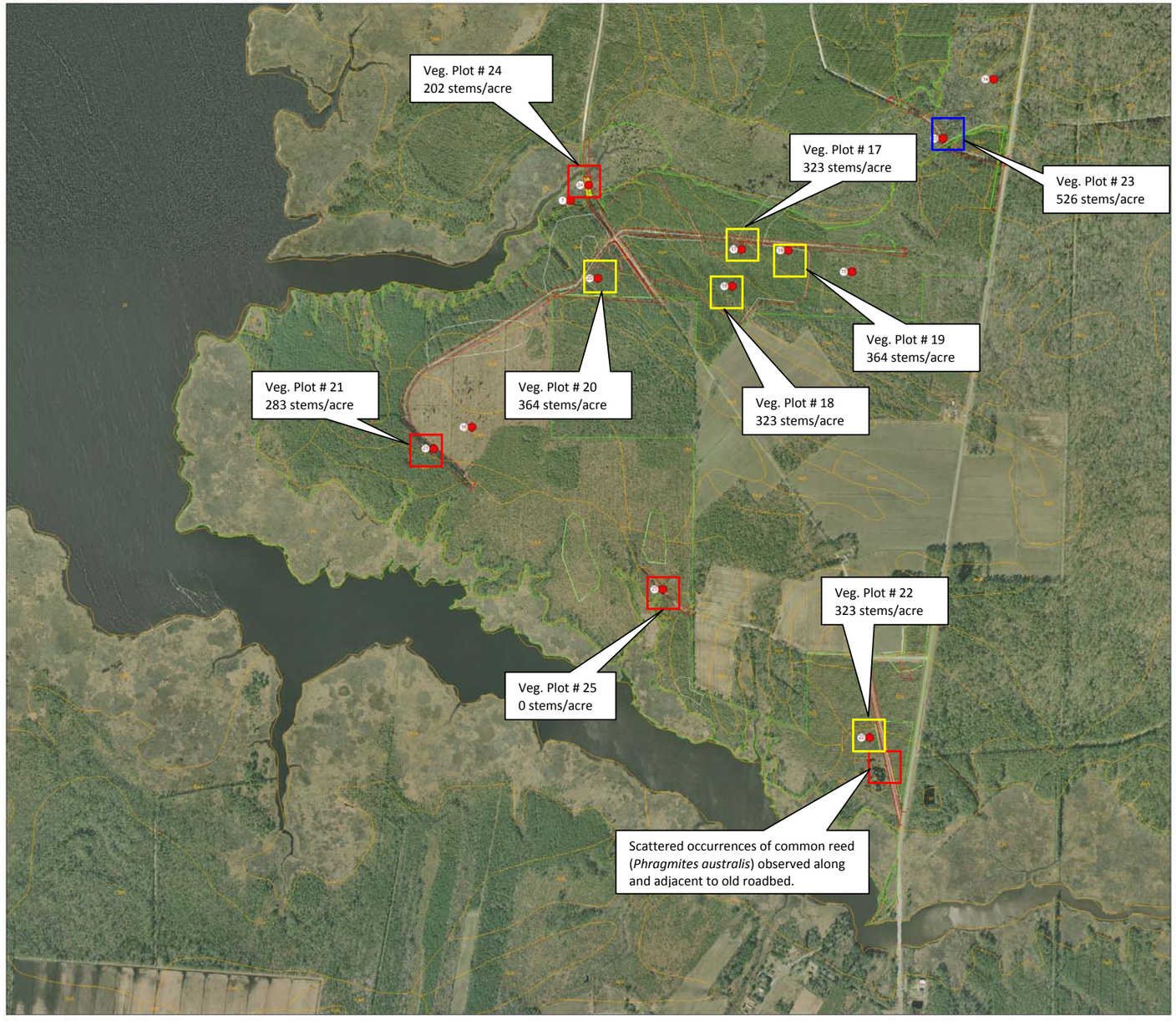
0 1,000 2,000 4,000 Feet

SCALE: 1:18,000

N W E S

PROJECT ATTRIBUTES
Bishop Road Wetland Mitigation Site
HYDE COUNTY, NORTH CAROLINA
Image: 1993 USGS DOQQ

Figure No.
2



khmiller 03/11/09

Bishop Road

Hyde County

2006 aerial photo from CGIA

ftp://204.211.239.203/outgoing/raster/local_imagery/hyde2006/sid/

N

0 65130 260 390 520 650 780 910 1,040

Meters

1 meter = 3.28 feet

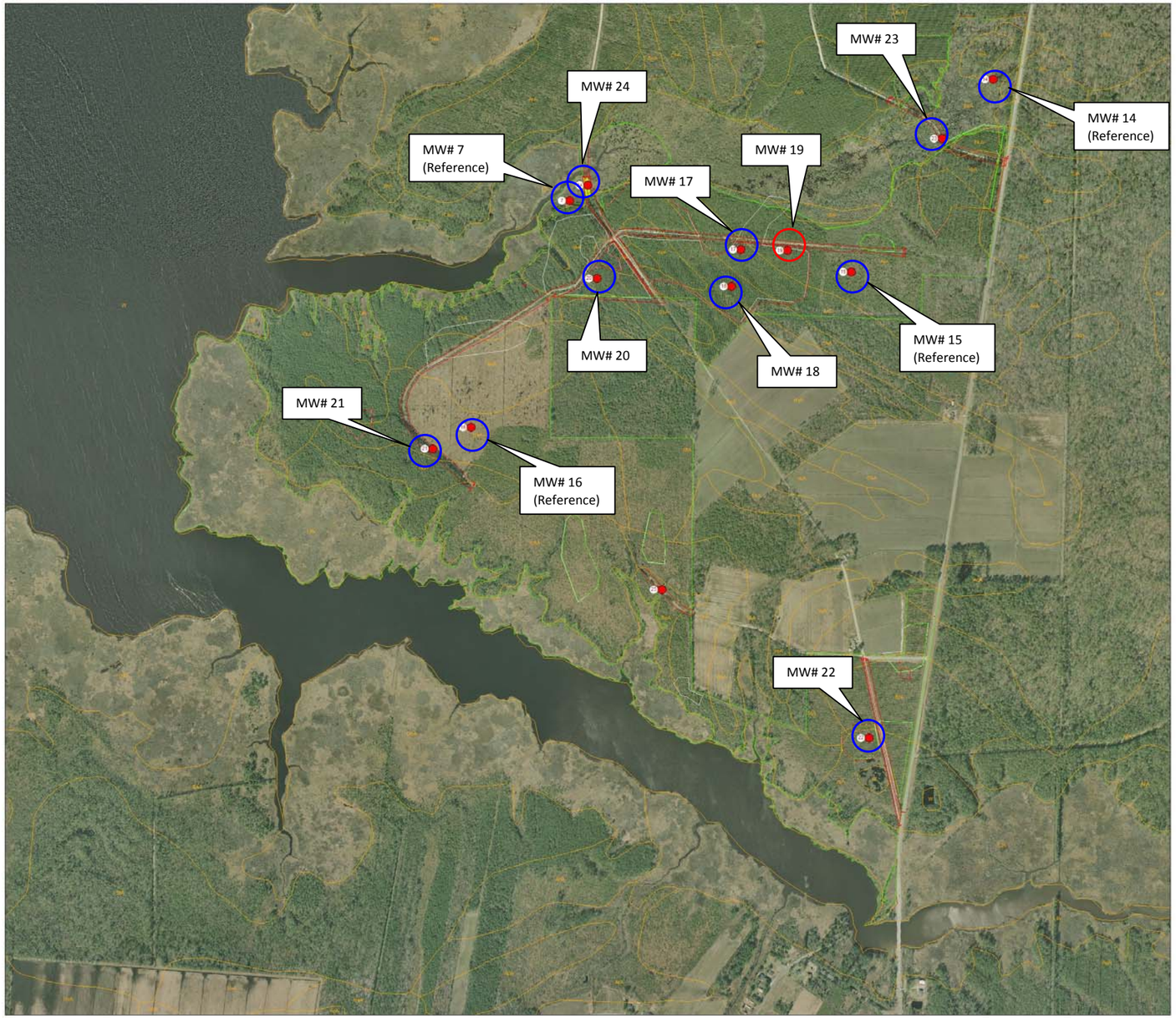
Vegetation Key

Denotes areas requiring attention or not meeting current mitigation thresholds

Denotes areas of potential concern due to low stem counts.

Denotes areas meeting mitigation expectations.

Ecosystem Enhancement Program	**Vegetation Problem Areas Plan View** **Monitoring Year 1 (2009) Assessment**	**Bishop Road Wetland Mitigation Site, Hyde County, NC** **EEP Project No. 38** Source: Miller, 2009	**Figure** **3**



khmiller 03/11/09

Bishop Road

Hyde County

2006 aerial photo from CGIA

ftp://204.211.239.203/outgoing/raster/local_imagery/hyde2006/sid/

N

0 65130 260 390 520 650 780 910 1,040

Meters

1 meter = 3.28 feet

Key

Monitoring well meets mitigation hydrology criteria.

Monitoring well does not meet mitigation hydrology criteria.

Ecosystem Enhancement Program	**Wetland Problem Areas Plan View** **Monitoring Year 1 (2009) 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 Site (EEP Project No. 38)	
Report Prepared By	Lane Sauls
Date Prepared	2/2/2010 10:06
Database Name	EcoEng-2009-A-38-BishopRoad-EntryTool-v227.mdb
Database Location	L:\Projects\50000 State\EEP 50512\50512-003 EEP Bishop Road\CVS DATA
Computer Name	LSAULS
File Size	68186112
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	38
Project Name	BISHOP ROAD
Description	Bishop Road Wetland Mitigation Site
River Basin	
Length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	0

Source: CVS-EEP Data Output

Appendix A Table 2. Vegetation Vigor by Species

Bishop Road Site (EEP Project No. 38)

	Species	CommonName	4	3	2	1	0	Missing	Unknown
	Alnus serrulata	hazel alder						1	
	Aronia arbutifolia	Red Chokeberry		1				2	
	Baccharis halimifolia	eastern baccharis		8					
	Nyssa aquatica	water tupelo				1		1	
	Pinus serotina	pond pine						1	
	Quercus pagoda	cherrybark oak			2				
	Quercus phellos	willow oak		2		1		1	
	Rosa palustris	swamp rose			2	6	8	8	
	Sambucus canadensis	Common Elderberry						3	
	Morella cerifera	wax myrtle		6				2	
	Ilex opaca	American holly			2	1		2	
	Quercus	oak		2	13	6		7	
	Magnolia virginiana	sweetbay		1					
	Hibiscus	rosemallow						1	
	Myrica	sweetgale		5	6	2			
TOTALS:	**15**	**15**		**25**	**25**	**17**	**8**	**29**	

Source: CVS-EEP Data Output

Appendix A Table 3. Vegetation Damage by Species

Bishop Road Site (EEP Project No. 38)

	Species	CommonName	Count of Damage Categories	(no damage)	Deer	Site Too Wet	Unknown
	Alnus serrulata	hazel alder	0	1			
	Aronia arbutifolia	Red Chokeberry	0	3			
	Baccharis halimifolia	eastern baccharis	0	8			
	Hibiscus	rosemallow	0	1			
	Ilex opaca	American holly	1	4			1
	Magnolia virginiana	sweetbay	0	1			
	Morella cerifera	wax myrtle	0	8			
	Myrica	sweetgale	2	11			2
	Nyssa aquatica	water tupelo	1	1			1
	Pinus serotina	pond pine	0	1			
	Quercus	oak	10	18	4		6
	Quercus pagoda	cherrybark oak	0	2			
	Quercus phellos	willow oak	1	3			1
	Rosa palustris	swamp rose	15	9		13	2
	Sambucus canadensis	Common Elderberry	0	3			
TOTALS:	**15**	**15**	**30**	**74**	**4**	**13**	**13**

Source: CVS-EEP Data Output

Appendix A Table 4. Vegetation Damage by Plot
Bishop Road Site (EEP Project No. 38)

	Plot	Count of Damage Categories	(no damage)	Deer	Site Too Wet	Unknown
	E38-01-Gauge17-year:1	1	11			1
	E38-01-Gauge18-year:1	0	11			
	E38-01-Gauge19-year:1	4	8	2		2
	E38-01-Gauge20-year:1	4	9			4
	E38-01-Gauge21-year:1	3	8			3
	E38-01-Gauge22-year:1	0	10			
	E38-01-Gauge23-year:1	5	12	2		3
	E38-01-Gauge24-year:1	5	5		5	
	E38-01-Gauge25-year:1	8			8	
TOTALS:	**9**	**30**	**74**	**4**	**13**	**13**

Source: CVS-EEP Data Output

Appendix A Table 5. Stem Count by Plot and Species

Bishop Road Site (EEP Project No. 38)

	Comment	Species	CommonName	Total Planted Stems	# Plots	Avg# Stems	Plot E38-01-Gauge17-year:1	Plot E38-01-Gauge18-year:1	Plot E38-01-Gauge19-year:1	Plot E38-01-Gauge20-year:1	Plot E38-01-Gauge21-year:1	Plot E38-01-Gauge22-year:1	Plot E38-01-Gauge23-year:1	Plot E38-01-Gauge24-year:1	Plot E38-01-Gauge25-year:1
		Aronia arbutifolia	Red Chokeberry	1	1	1			1						
		Baccharis halimifolia	eastern baccharis	8	1	8						8			
		Ilex opaca	American holly	3	2	1.5	1	2							
		Magnolia virginiana	sweetbay	1	1	1	1								
		Morella cerifera	wax myrtle	6	3	2	3		2		1				
		Myrica	sweetgale	13	3	4.33		4		3			6		
		Nyssa aquatica	water tupelo	1	1	1							1		
		Quercus	oak	21	6	3.5	3	2	4	2	5		5		
		Quercus pagoda	cherrybark oak	2	1	2			2						
		Quercus phellos	willow oak	3	2	1.5				2	1				
		Rosa palustris	swamp rose	8	3	2.67				2			1	5	
	n/a: no stems			0	1										0
TOTALS:	**1**	**11**	**11**	**67**	**12**		**8**	**8**	**9**	**9**	**7**	**8**	**13**	**5**	**0**

Source: CVS-EEP Data Output

Appendix A Table 6. Vegetative Problem Areas
Bishop Road Site (EEP Project No. 38)

Feature/Issue	Station/Range	Probable Cause	Photo #
Vegetation Plot # 21	n/a	Unknown	VP - 21
Vegetation Plot # 24	n/a	Inundation	VP - 24
Vegetation Plot # 25	n/a	Inundation	VP - 25
Phragmites australis	n/a	Invasive Species	n/a

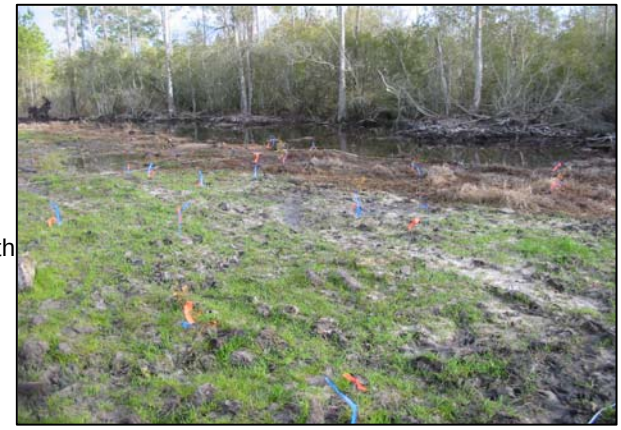
Appendix A Table 7. Planted and Total Stem Count Summary
EEP Project Code 38. Project Name: BISHOP ROAD

			Current Plot Data (MY1 2009)																										Annual Means					
			E38-01-Gauge17			E38-01-Gauge18			E38-01-Gauge19			E38-01-Gauge20			E38-01-Gauge21			E38-01-Gauge22			E38-01-Gauge23			E38-01-Gauge24			E38-01-Gauge25			MY1 (2009)			MY0 (2009)		
Scientific Name	**Common Name**	**Species Type**	**P-LS**	**P-all**	**T**	**P-LS**	**P-all**	**T**	**P-LS**	**P-all**	**T**	**P-LS**	**P-all**	**T**	**P-LS**	**P-all**	**T**	**P-LS**	**P-all**	**T**	**P-LS**	**P-all**	**T**	**P-LS**	**P-all**	**T**	**P-LS**	**P-all**	**T**	**P-LS**	**P-all**	**T**	**P-LS**	**P-all**	**T**
Acer	maple				3			2			1																				6			
Acer rubrum	red maple	Tree																																27
Alnus serrulata	hazel alder	Shrub Tree																														1		1
Aronia arbutifolia	Red Chokeberry	Shrub								1	1																			1	1	3		3
Baccharis	baccharis	Shrub Tree									3			4			41			6			67								121			
Baccharis halimifolia	eastern baccharis	Shrub Tree																	8	8										8	8		8	19
Clethra alnifolia	coastal sweetpepperbush	Shrub																																7
Hibiscus	rosemallow	Shrub Tree																														1		1
Ilex opaca	American holly	Shrub Tree		1	1		2	2																						3	3	5		5
Ligustrum	privet	Shrub Tree												1																	1			
Liquidambar styraciflua	sweetgum	Tree			2			4			3																				9			25
Magnolia virginiana	sweetbay	Shrub Tree		1	1																									1	1	1		1
Morella	bayberry	Shrub Tree												2			1			2											5			
Morella cerifera	wax myrtle	Shrub Tree		3	3			2		2	2					1	1													6	8		8	12
Myrica	sweetgale	Shrub					4	4					3	3								6	6							13	13		13	17
Nyssa aquatica	water tupelo	Tree																				1	1							1	1		2	2
Persea	bay										1																				1			
Pinus serotina	pond pine	Tree																															1	1
Quercus	oak	Shrub Tree		3	3		2	2		4	4		2	2		5	5					5	5							21	21		31	33
Quercus pagoda	cherrybark oak	Tree						1		2	2																			2	3			
Quercus phellos	willow oak	Tree											2	2		1	1													3	3		3	3
Rhus	sumac				7			10			3			16																	36			
Rhus copallinum	flameleaf sumac	Shrub Tree																																40
Rosa palustris	swamp rose	Shrub											2	2								1	1		5	5					8	8		24	24
Sambucus canadensis	Common Elderberry	Shrub Tree																																3	3
Unknown																										15					15			1
Vaccinium	blueberry	Shrub Vine Tree						1																							1			
		Stem count	0	8	20	0	8	28	0	9	20	0	9	32	0	7	49	0	8	16	0	13	80	0	5	20	0	0	0	0	67	265	0	104	225
		size (ares)	1			1			1			1			1			1			1			1			1			9			9		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.22			0.22		
		Species count	0	4	7	0	3	9	0	4	9	0	4	8	0	3	5	0	1	3	0	4	5	0	1	2	0	0	0	0	11	20	0	14	19
		Stems per ACRE	0	323.75	809.37	0	323.75	1133.1	0	364.22	809.37	0	364.22	1295	0	283.28	1983	0	323.75	647.5	0	526.09	3237.5	0	202.34	809.37	0	0	0	0	301.27	1191.6	0	467.64	1011.7

Source: CVS-EEP Data Output

Vegetation Plot Photograph Summary

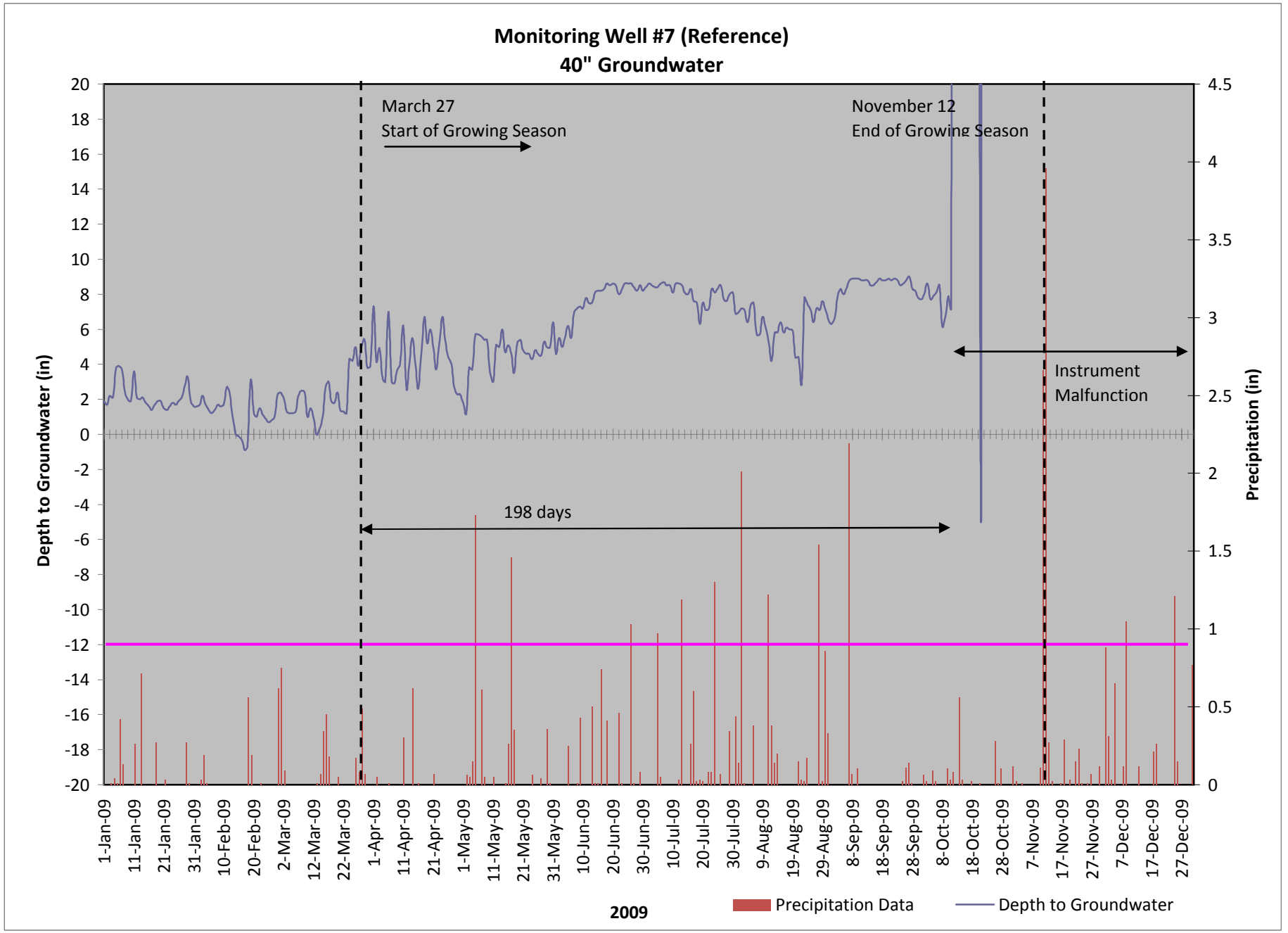
Photograph Number and Location	February 12, 2009 Baseline	January 2010 Monitoring Year 1
Photo # VP-17 Facing Southwest		
Photo # VP-18 Facing Northeast		
Photo # VP-19 Facing Southwest		

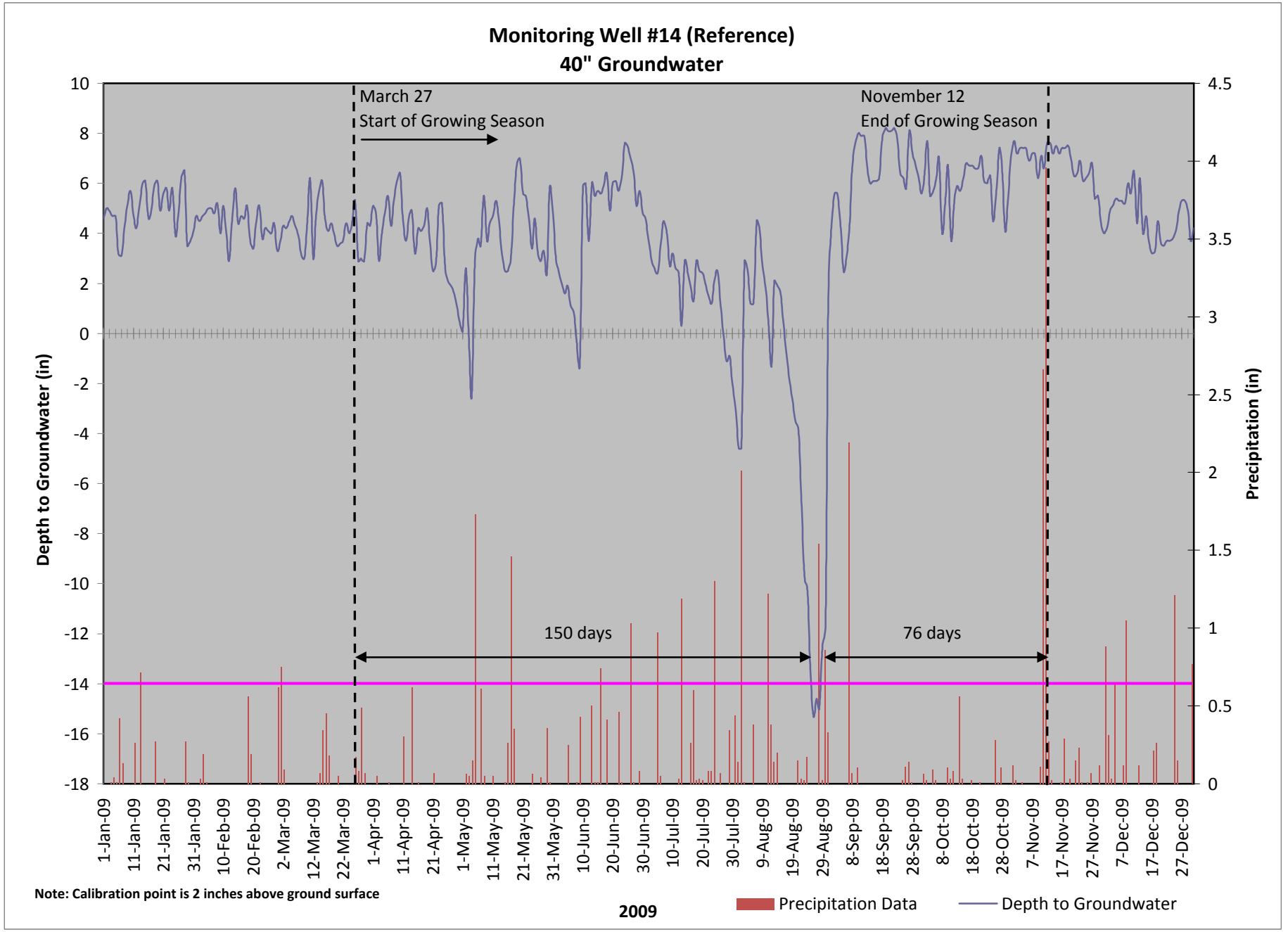
Photograph Number and Location	February 12, 2009 Baseline	January 2010 Monitoring Year 1
Photo # VP-20 Facing East		
Photo # VP-21 Facing West		
Photo # VP-22 Facing West		
Photo # VP-23 Facing North		

Photograph Number and Location	February 12, 2009 Baseline	January 2010 Monitoring Year 1
Photo # VP-24 Facing North		
Photo # VP-25 Facing North		

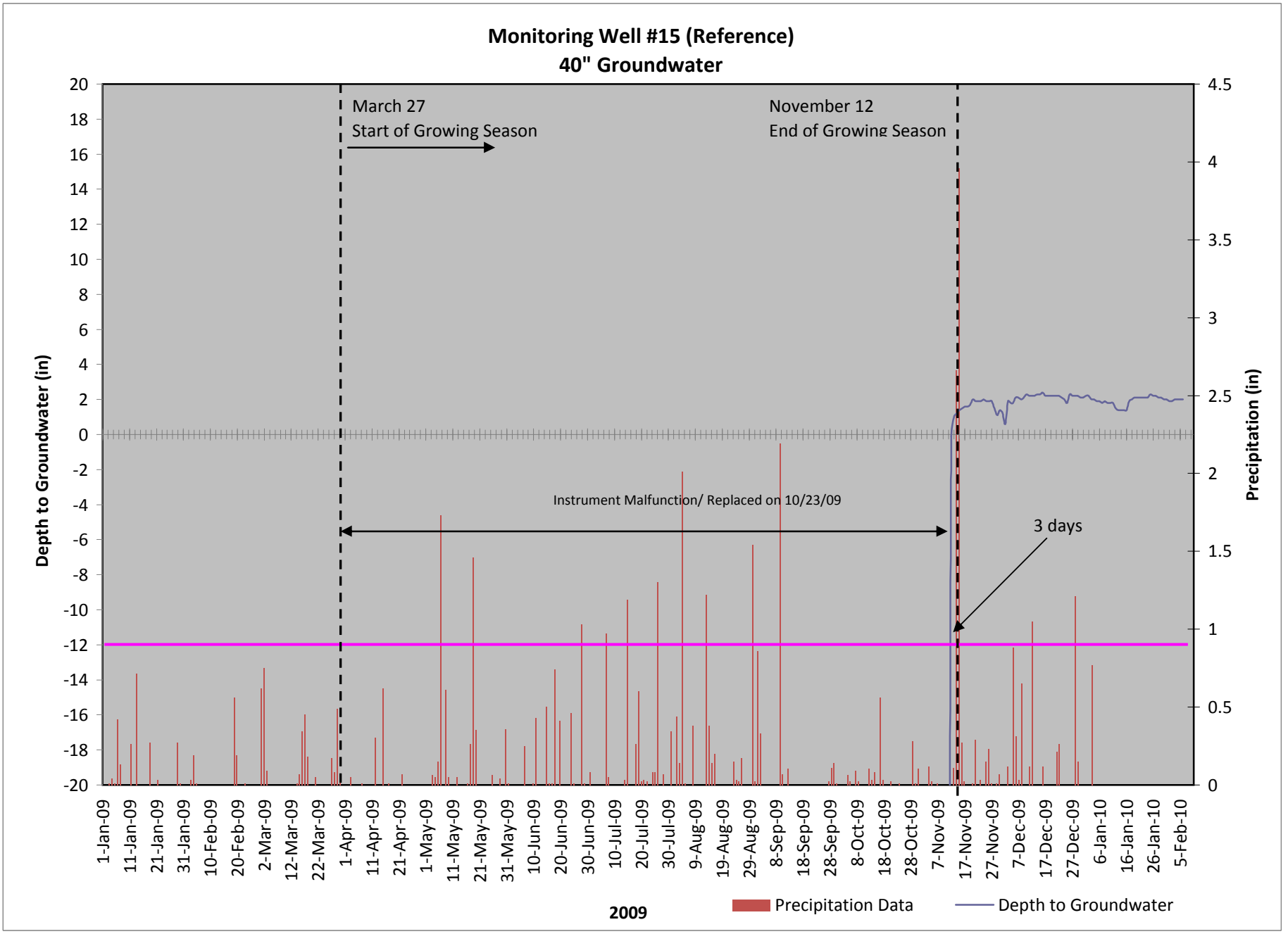
Appendix B

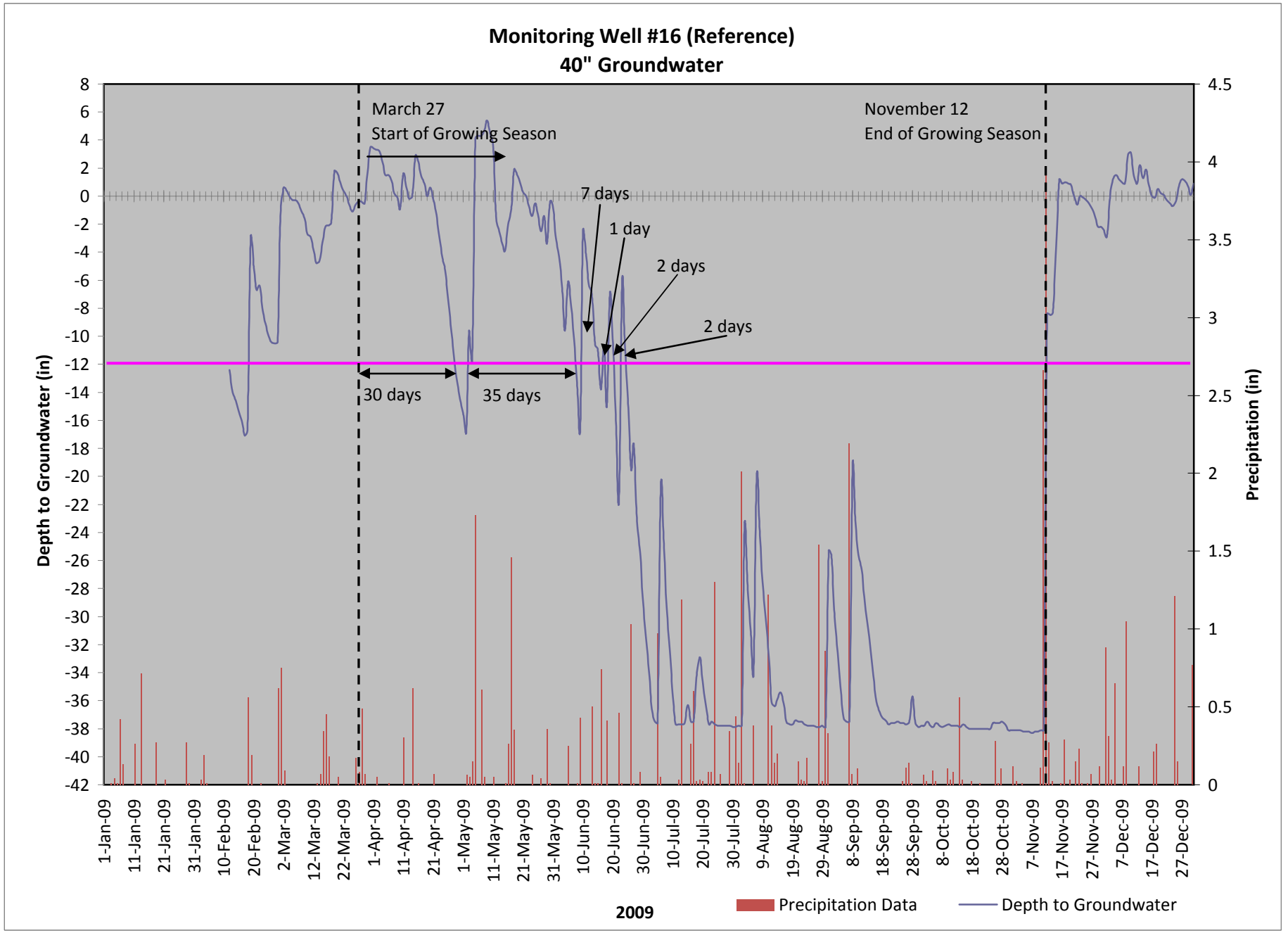
Wetland Raw Data

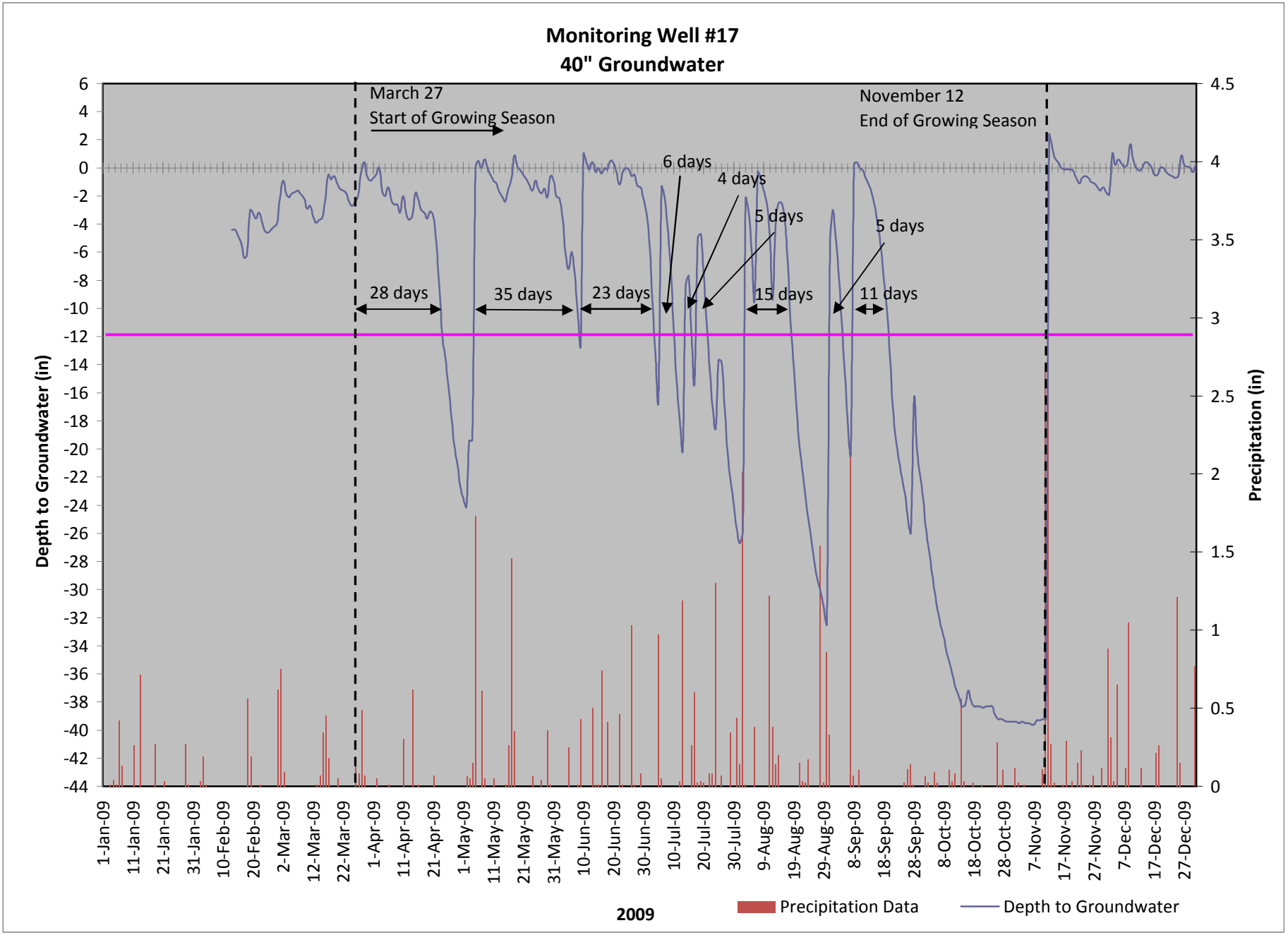

Monitoring Well #7 (Reference)
40" Groundwater
March 27
Start of Growing Season
November 12
End of Growing Season
Instrument
Malfunction
198 days
Depth to Groundwater (in)
Precipitation (in)
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1-Jan-09
11-Jan-09
21-Jan-09
31-Jan-09
10-Feb-09
20-Feb-09
2-Mar-09
12-Mar-09
22-Mar-09
1-Apr-09
11-Apr-09
21-Apr-09
1-May-09
11-May-09
21-May-09
31-May-09
10-Jun-09
20-Jun-09
30-Jun-09
10-Jul-09
20-Jul-09
30-Jul-09
9-Aug-09
19-Aug-09
29-Aug-09
8-Sep-09
18-Sep-09
28-Sep-09
8-Oct-09
18-Oct-09
28-Oct-09
7-Nov-09
17-Nov-09
27-Nov-09
7-Dec-09
17-Dec-09
27-Dec-09
2009
Precipitation Data
Depth to Groundwater

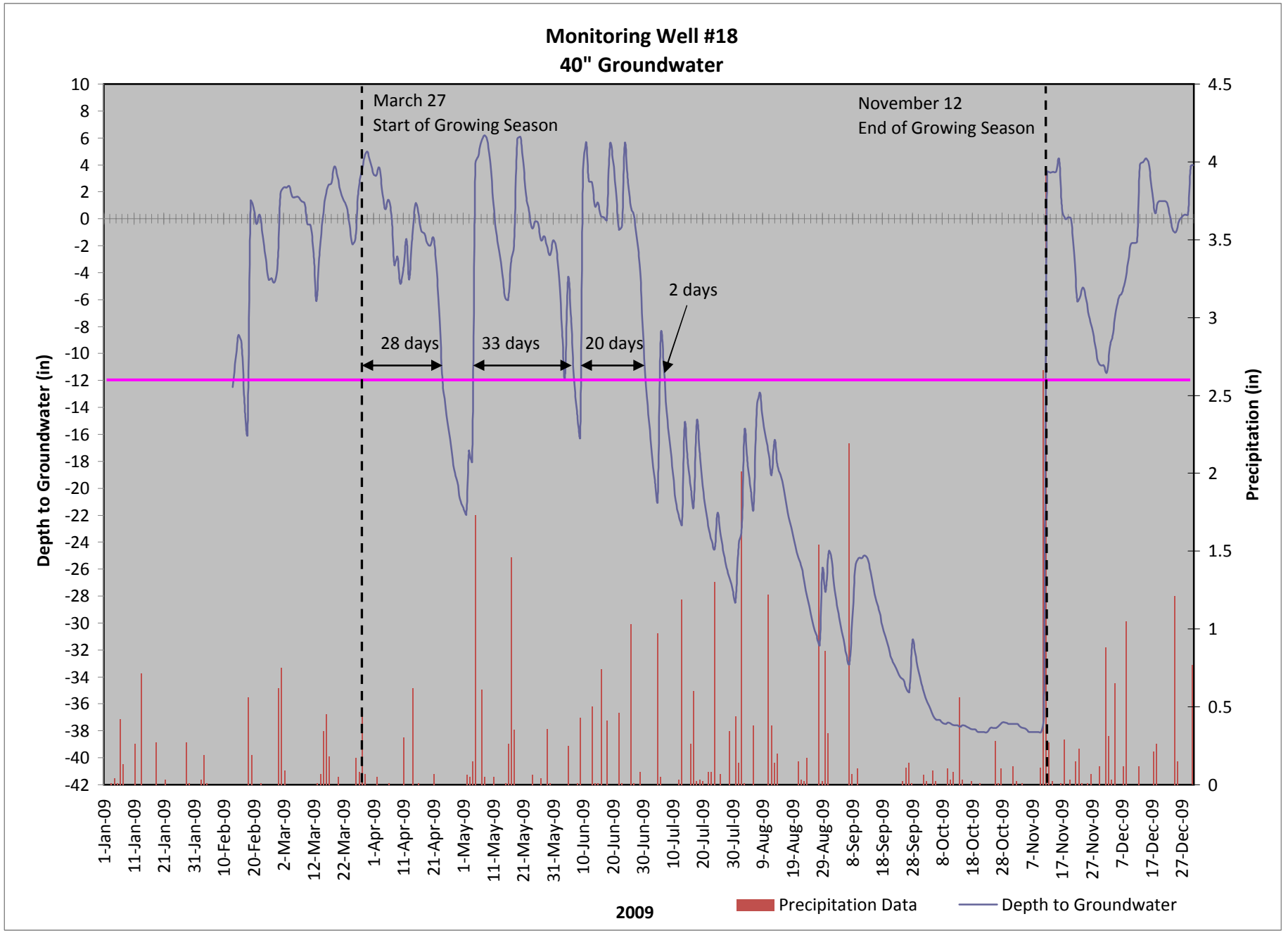


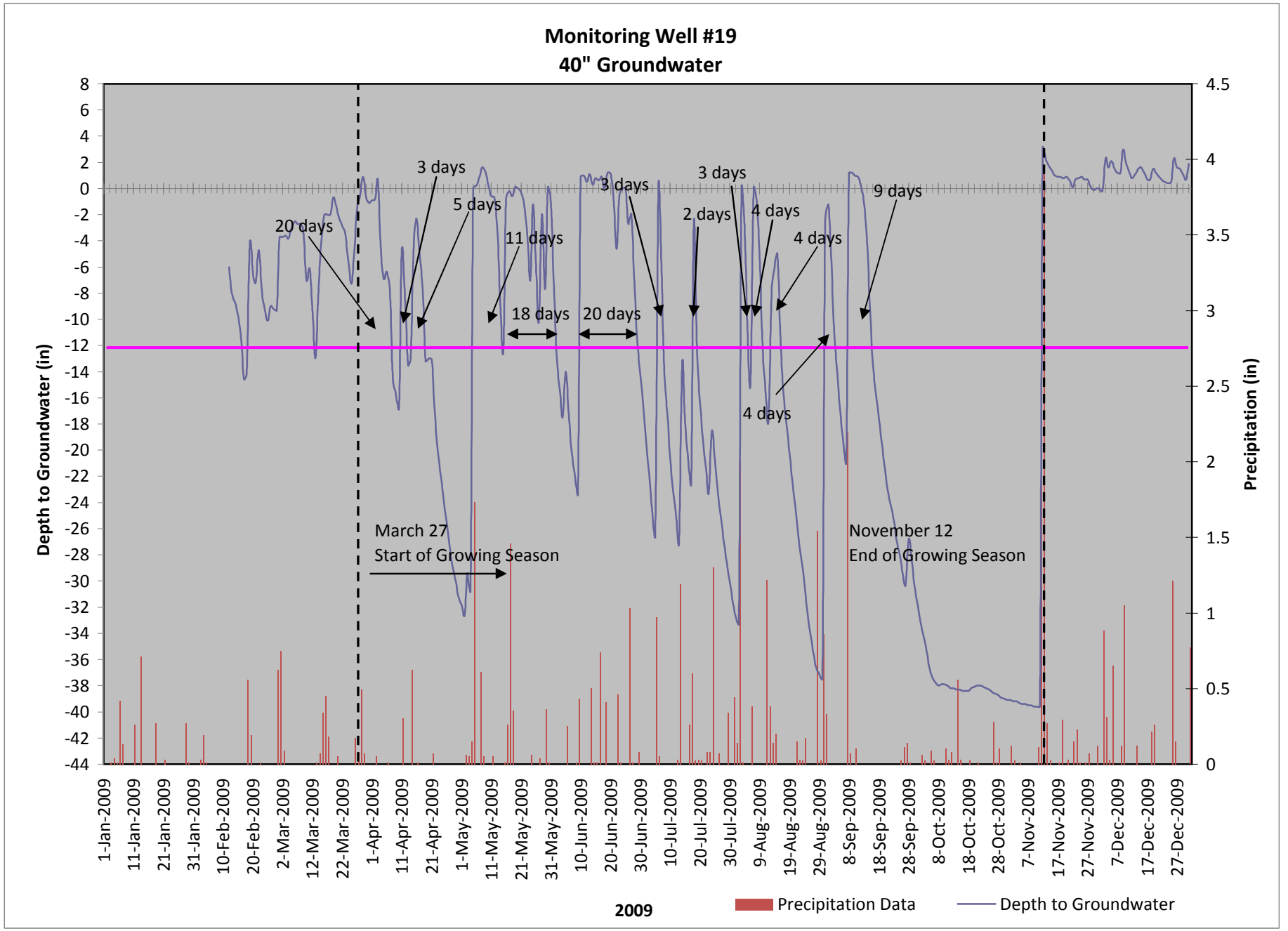
Note: Calibration point is 2 inches above ground surface

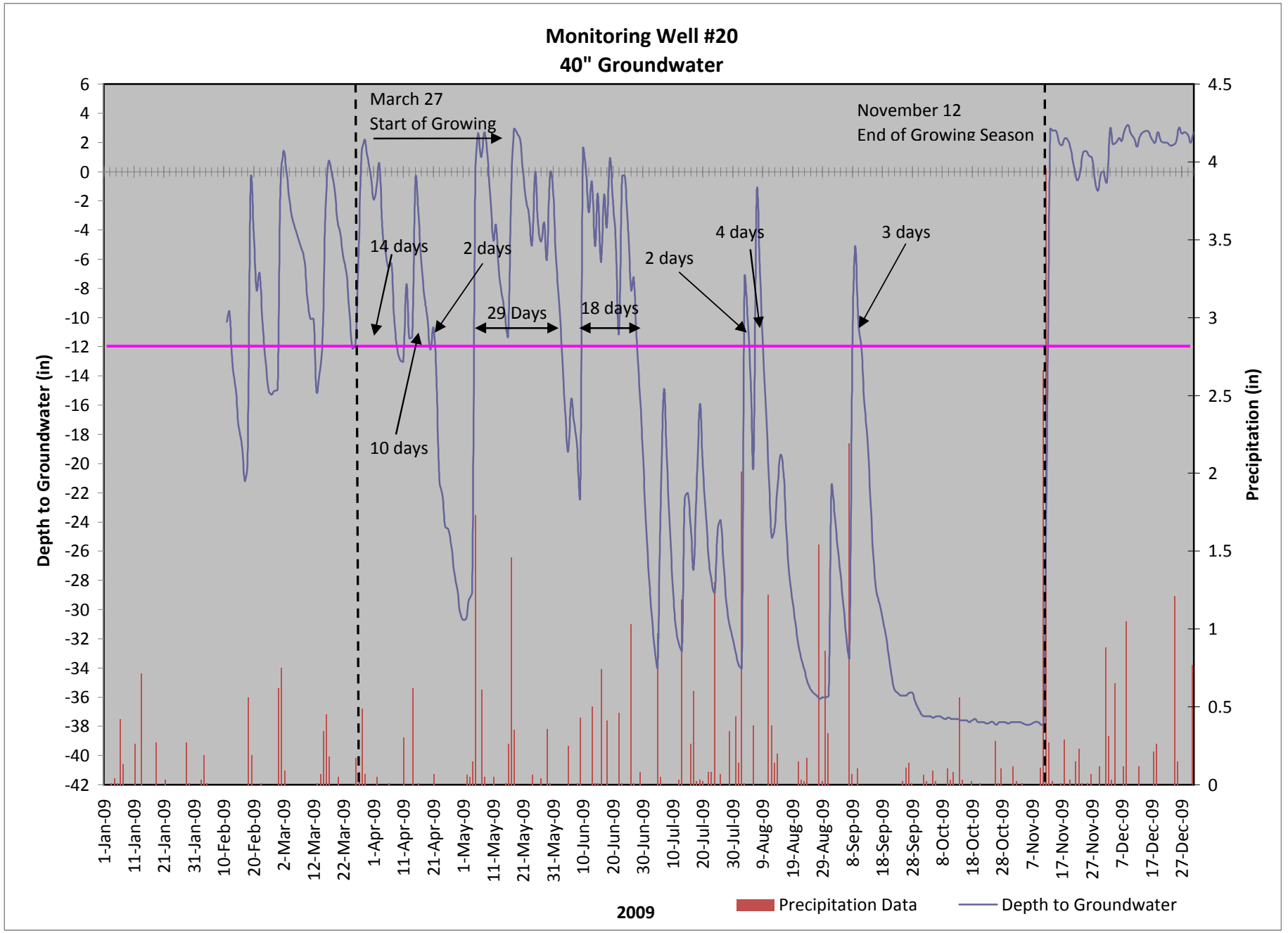

Monitoring Well #15 (Reference)
40" Groundwater
March 27
Start of Growing Season
November 12
End of Growing Season
Instrument Malfunction/ Replaced on 10/23/09
3 days
Depth to Groundwater (in)
Precipitation (in)
2009
Precipitation Data
Depth to Groundwater

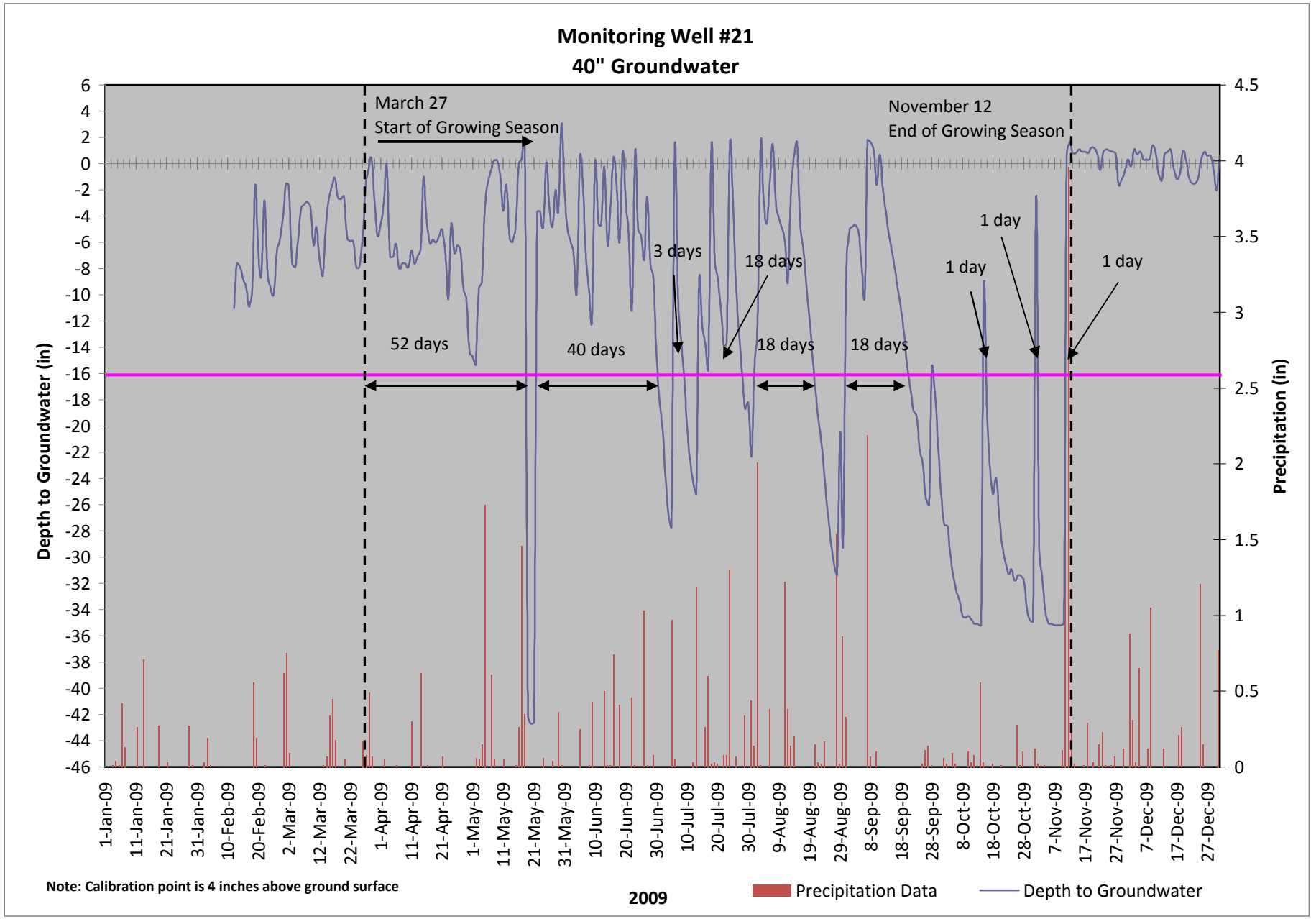

Monitoring Well #16 (Reference)
40" Groundwater
March 27
Start of Growing Season
November 12
End of Growing Season
7 days
1 day
2 days
2 days
30 days
35 days
Depth to Groundwater (in)
Precipitation (in)
2009
Precipitation Data
Depth to Groundwater

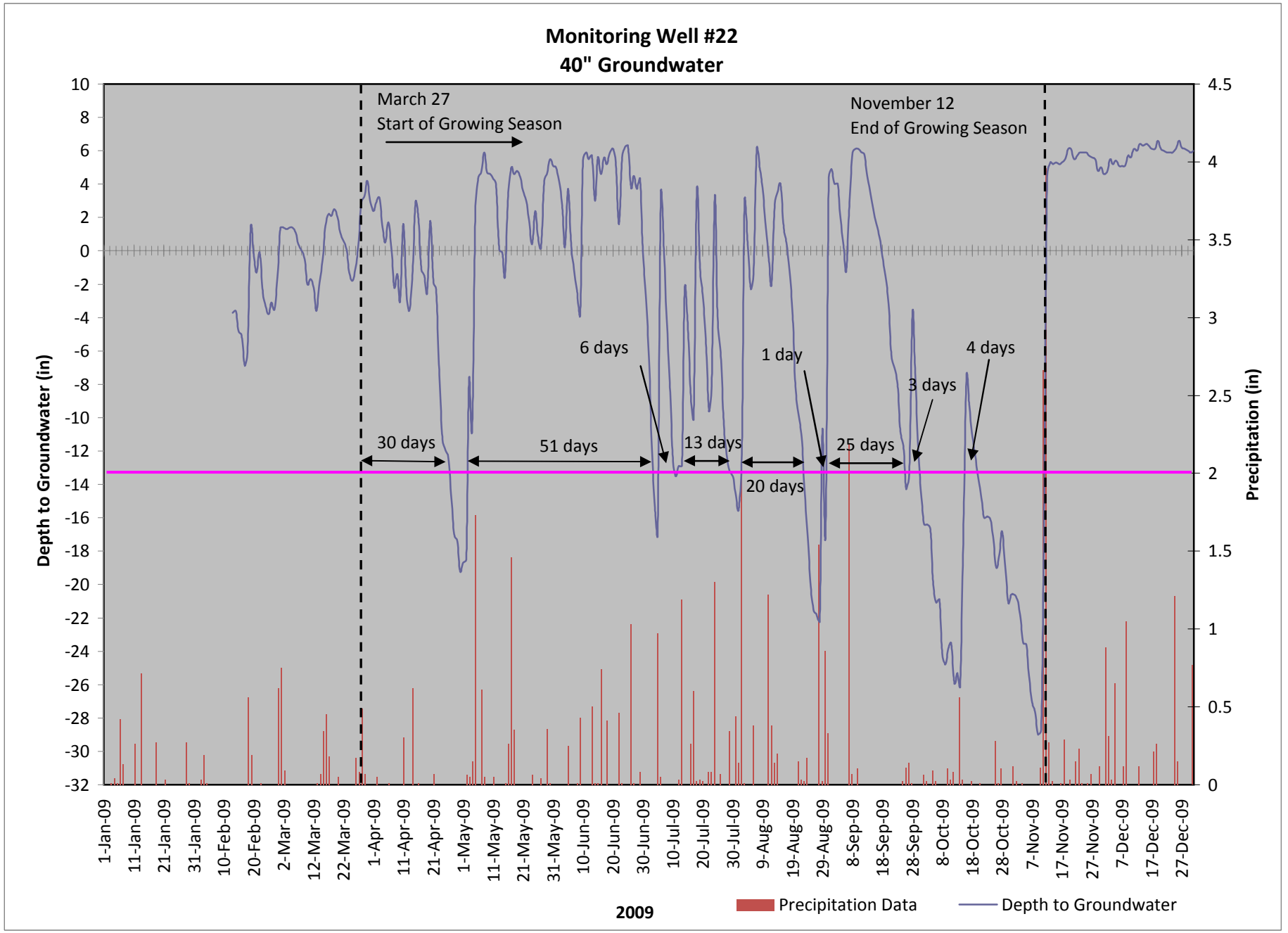

Monitoring Well #17
40" Groundwater
March 27
Start of Growing Season
November 12
End of Growing Season
6 days
4 days
5 days
5 days
28 days
35 days
23 days
15 days
11 days
Depth to Groundwater (in)
Precipitation (in)
2009
Precipitation Data
Depth to Groundwater

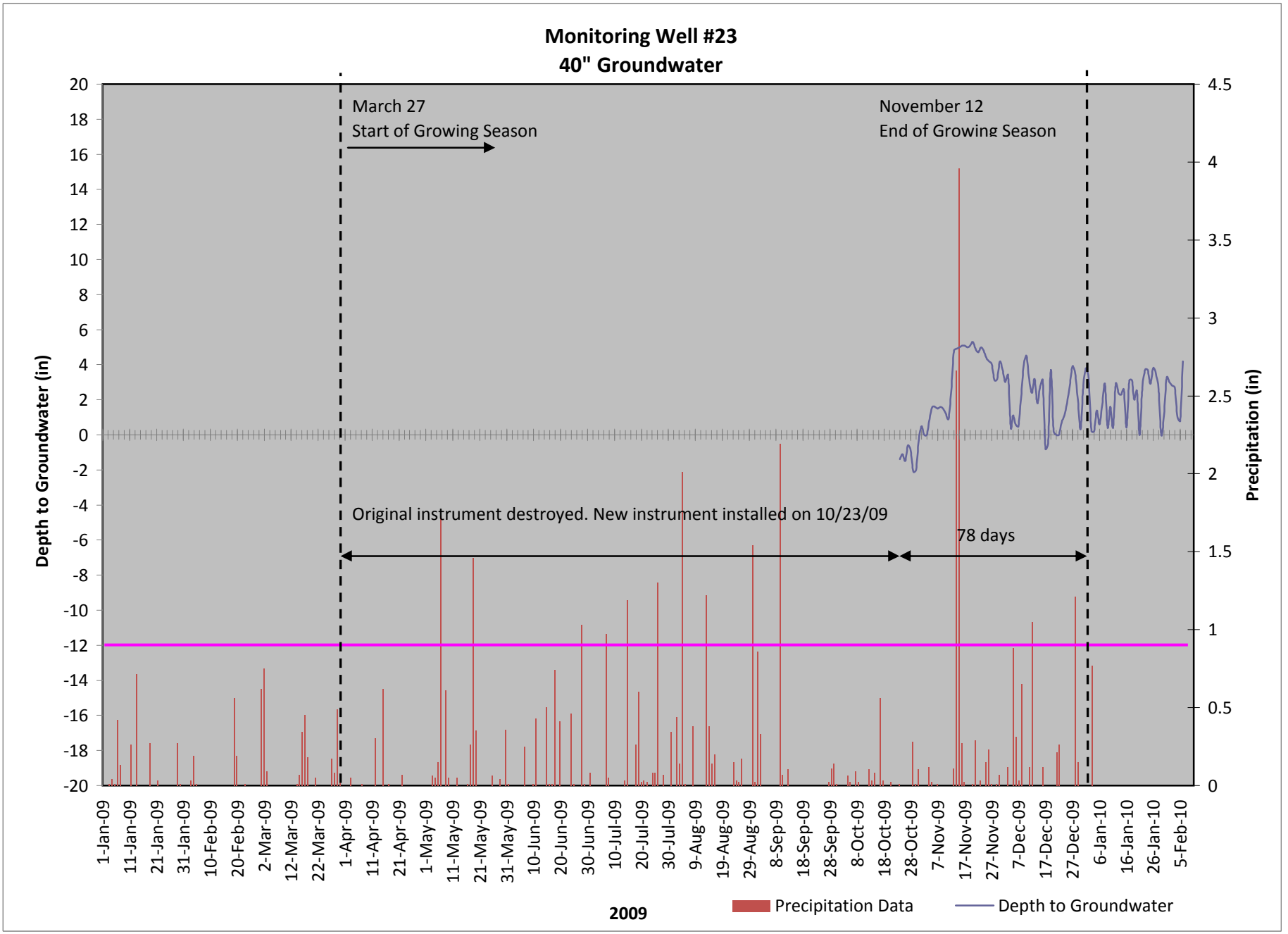

Monitoring Well #18
40" Groundwater
March 27
Start of Growing Season
November 12
End of Growing Season
2 days
28 days
33 days
20 days
Depth to Groundwater (in)
Precipitation (in)
2009
Precipitation Data
Depth to Groundwater

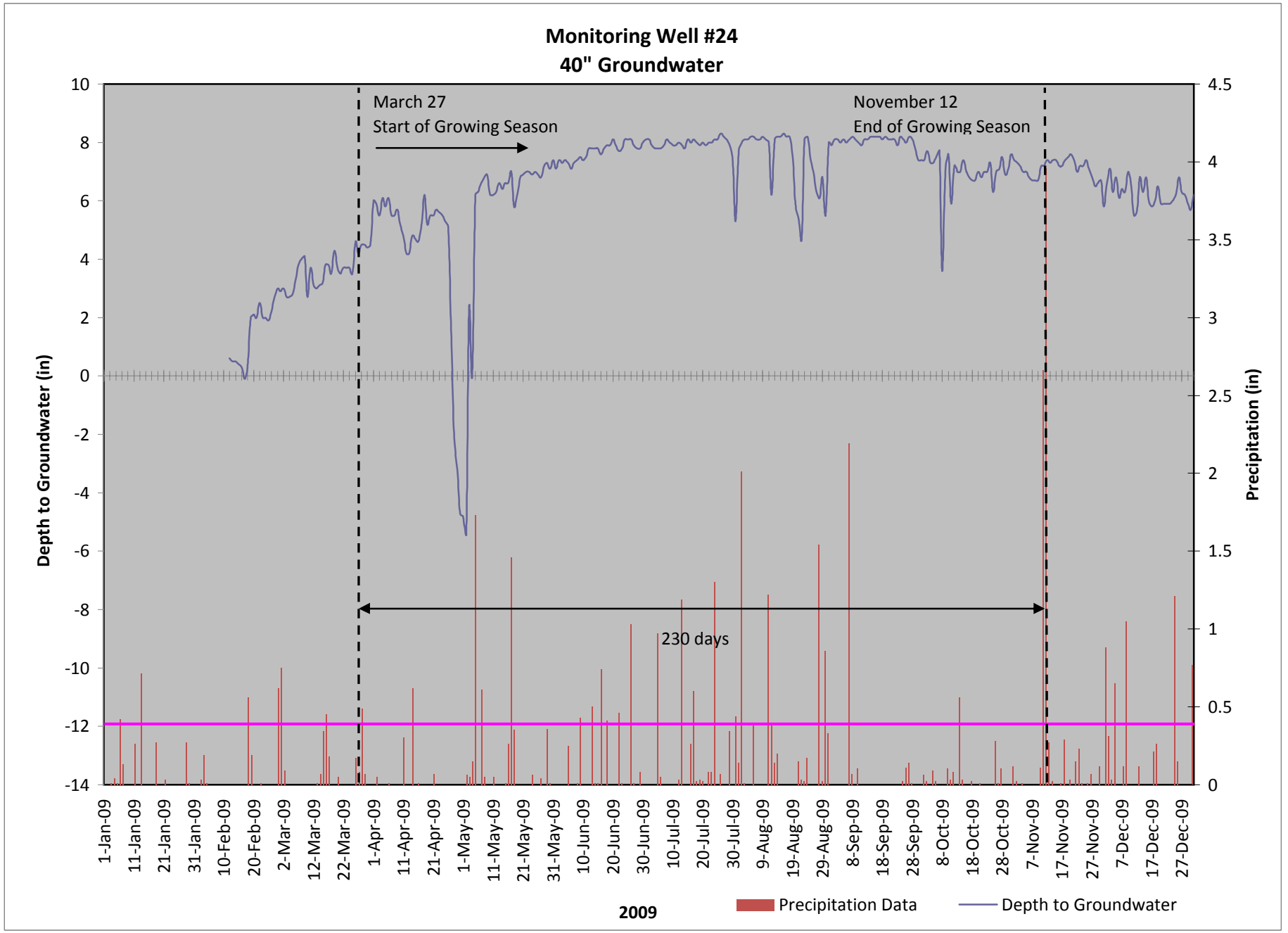

Monitoring Well #19
40" Groundwater
Depth to Groundwater (in)
Precipitation (in)
20 days
3 days
5 days
11 days
18 days
20 days
3 days
3 days
2 days
4 days
4 days
9 days
4 days
March 27
Start of Growing Season
November 12
End of Growing Season
2009
Precipitation Data
Depth to Groundwater


Monitoring Well #20
40" Groundwater
March 27
Start of Growing
November 12
End of Growing Season
14 days
2 days
29 Days
18 days
2 days
4 days
3 days
10 days
Depth to Groundwater (in)
Precipitation (in)
2009
Precipitation Data
Depth to Groundwater


Monitoring Well #21
40" Groundwater
March 27
Start of Growing Season
November 12
End of Growing Season
52 days
40 days
3 days
18 days
18 days
18 days
1 day
1 day
1 day
Depth to Groundwater (in)
Precipitation (in)
Note: Calibration point is 4 inches above ground surface
2009
Precipitation Data
Depth to Groundwater


Monitoring Well #22
40" Groundwater
March 27
Start of Growing Season
November 12
End of Growing Season
6 days
1 day
4 days
3 days
30 days
51 days
13 days
20 days
25 days
Depth to Groundwater (in)
Precipitation (in)
2009
Precipitation Data
Depth to Groundwater


Monitoring Well #23
40" Groundwater
March 27
Start of Growing Season
November 12
End of Growing Season
Original instrument destroyed. New instrument installed on 10/23/09
78 days
Depth to Groundwater (in)
Precipitation (in)
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1-Jan-09
11-Jan-09
21-Jan-09
31-Jan-09
10-Feb-09
20-Feb-09
2-Mar-09
12-Mar-09
22-Mar-09
1-Apr-09
11-Apr-09
21-Apr-09
1-May-09
11-May-09
21-May-09
31-May-09
10-Jun-09
20-Jun-09
30-Jun-09
10-Jul-09
20-Jul-09
30-Jul-09
9-Aug-09
19-Aug-09
29-Aug-09
8-Sep-09
18-Sep-09
28-Sep-09
8-Oct-09
18-Oct-09
28-Oct-09
7-Nov-09
17-Nov-09
27-Nov-09
7-Dec-09
17-Dec-09
27-Dec-09
6-Jan-10
16-Jan-10
26-Jan-10
5-Feb-10
2009
Precipitation Data
Depth to Groundwater


Monitoring Well #24
40" Groundwater
March 27
Start of Growing Season
November 12
End of Growing Season
230 days
Depth to Groundwater (in)
Precipitation (in)
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1-Jan-09
11-Jan-09
21-Jan-09
31-Jan-09
10-Feb-09
20-Feb-09
2-Mar-09
12-Mar-09
22-Mar-09
1-Apr-09
11-Apr-09
21-Apr-09
1-May-09
11-May-09
21-May-09
31-May-09
10-Jun-09
20-Jun-09
30-Jun-09
10-Jul-09
20-Jul-09
30-Jul-09
9-Aug-09
19-Aug-09
29-Aug-09
8-Sep-09
18-Sep-09
28-Sep-09
8-Oct-09
18-Oct-09
28-Oct-09
7-Nov-09
17-Nov-09
27-Nov-09
7-Dec-09
17-Dec-09
27-Dec-09
2009
Precipitation Data
Depth to Groundwater