

**Bishop Road Wetland Mitigation Site
Monitoring Year 3 (2011)**

**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

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*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.*

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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. The Bishop Road Site was purchased in the spring of 2001 from Weyerhaeuser Corporation. According to Weyerhaeuser, 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. During 2010, Ecological Engineering added three additional vegetation plots to the overall assessment. The downloading of well data occurred three times during the year. 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 Year 3 vegetation monitoring effort was performed by determining density and survival of planted species, consistent with prescribed Carolina Vegetation Survey (CVS) protocols. Nine 100-meter² (wetland) and three 50-meter² (buffer) plot locations were assessed. Based on survey data, the mean stem count for all of the plots combined totaled 235 planted stems per acre and 3,549 total stems per acre. Four of nine wetland plots and zero of three buffer plots met the 320-count threshold. Of the remaining five wetland plots, three exhibited planted stem counts between 121 and 283 stems per acre and two exhibited no planted stems. The remaining buffer plots exhibited between 145 and 217 stems per acre. Supplemental planting was implemented as part of the construction warranty during early 2010.

Wetland Assessment

Wetland assessments associated with the Year 3 monitoring effort were performed by collecting groundwater hydrology via monitoring wells that record daily groundwater elevations. Based on the results, all 12 wells met the criteria established for wetland hydrology.

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 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, non-riparian hardwood flats, coastal marshes and riverine 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-meter² 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 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 ± 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 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 ± 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 |
| Totals | n/a | 62.7 | 0 | 338.80 | 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 |
| Warranty Planting | n/a | March 2010 |
| Year 2 Monitoring | November 2010 | December 2010 |
| Year 3 Monitoring | November 2011 | December 2011 |
| 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 | <table border="0"> <tr> <td>Mellow Marsh Farms Siler City, NC 919.742.1200</td> <td>Coastal Plain Conservation Nursery Edenton, NC 252.482.5707</td> </tr> <tr> <td>SC Super Tree Nursery Blenheim, SC 843.528.3943</td> <td>Weyerhaeuser NR Company Atlanta, GA 800.221.4898</td> </tr> </table> | Mellow Marsh Farms Siler City, NC 919.742.1200 | Coastal Plain Conservation Nursery Edenton, NC 252.482.5707 | SC Super Tree Nursery Blenheim, SC 843.528.3943 | Weyerhaeuser NR Company Atlanta, GA 800.221.4898 |
| Mellow Marsh Farms Siler City, NC 919.742.1200 | Coastal Plain Conservation Nursery Edenton, NC 252.482.5707 | | | | |
| SC 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 | | | | |

Source: EEP, 2009

| 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

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 2011 results have not been any different. According to the NC Drought Management Advisory Council (2011), Hyde County experienced seven weeks of abnormally dry, four weeks of moderate drought, five weeks of severe drought and eight weeks of extreme drought conditions during this year's growing season. The following chart denotes the drought status and subsequent dates with respect to Hyde County.

| <u>Abnormally Dry (DO)</u> | <u>Moderate Drought (D1)</u> | <u>Severe Drought (D2)</u> | <u>Extreme Drought (D3)</u> |
|----------------------------|------------------------------|----------------------------|-----------------------------|
| March 15 | May 3 | May 31 | July 5 |
| March 22 | May 10 | June 7 | July 12 |
| March 29 | May 17 | June 14 | July 19 |
| April 5 | May 24 | June 21 | July 26 |
| April 12 | | June 28 | August 2 |
| April 19 | | | August 9 |
| April 26 | | | August 16 |
| | | | August 23 |

Source: NC Drought Management Advisory Council (2011).

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, stem counts were updated during Year 2 monitoring activities.

Year 3 monitoring results were slightly lower than Year 2 results for planted stems; however, volunteer stems significantly increased the overall mean. The means for planted and total stems were 235 and 3,549 stems per acre as compared with the Year 2 results of 246 and 2,567 stems per acre, respectively.

Four of the nine wetland vegetation plots met the three-year threshold amount for planted stems. In addition, Vegetation Plots #24 and #25 were also investigated for percent cover. Neither exhibited any planted stems; however, Vegetation Plot #24 averaged a volunteer stem count of approximately 526 stems per acre. Its overall coverage was estimated at 80 percent. The actual coverage at Vegetation Plot #25 was estimated at 10 percent. The absence of planted stems throughout these two areas is likely the result of high water levels during the initial planting year. None of the three buffer plots met the success criteria of 320 planted stems per acre. These plots exhibited planted stems at a density between 145 and 217 stems per acre. Volunteer species counts for these plots ranged however, from 3,778 to 6,030 stems per acre. Exhibit Table V summarizes the vegetation criteria attainment. In addition, Vegetation Plot #25 did not exhibit any cover during the Year 3 monitoring assessment.

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 utilized a contractor to spray this species during the growing season of Year 3. Based on the site visit in November, this species has been effectively controlled for the time-being. Several small populations remain, which will be controlled as necessary during Year 4 of the 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 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 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 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 12 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 of the 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 >12.5% | 29% | | | |
| MW# 14 (Reference) | Yes 5% - 12.5% | 10% | | | |
| MW# 15 (Reference) | Yes 5% -12.5% | 61% | | | |
| MW# 16 (Reference) | Yes 5% -12.5% | | | | |
| MW# 17 | Yes >12.5% | 61% | VP# 17 | Yes | 61% |
| MW# 18 | Yes 5% -12.5% | | VP# 18 | Yes | |
| MW# 19 | Yes >12.5% | | VP# 19 | Yes | |
| MW# 20 | Yes >12.5% | | VP# 20 | No | |
| MW# 21 | Yes >12.5% | | VP# 21 | No | |
| MW# 22 | Yes >12.5% | | VP# 22 | Yes | |
| MW# 23 | Yes >12.5% | 10% | VP# 23 | No | 10% |
| MW# 24 | Yes >12.5% | 29% | VP# 24 | No | 29% |
| | | | VP# 25 | No | |
| | | | Tarklin Creek | No | <1% |
| | | | SW Scranton | No | |
| | | | NW Scranton | No | |

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-meter² 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).

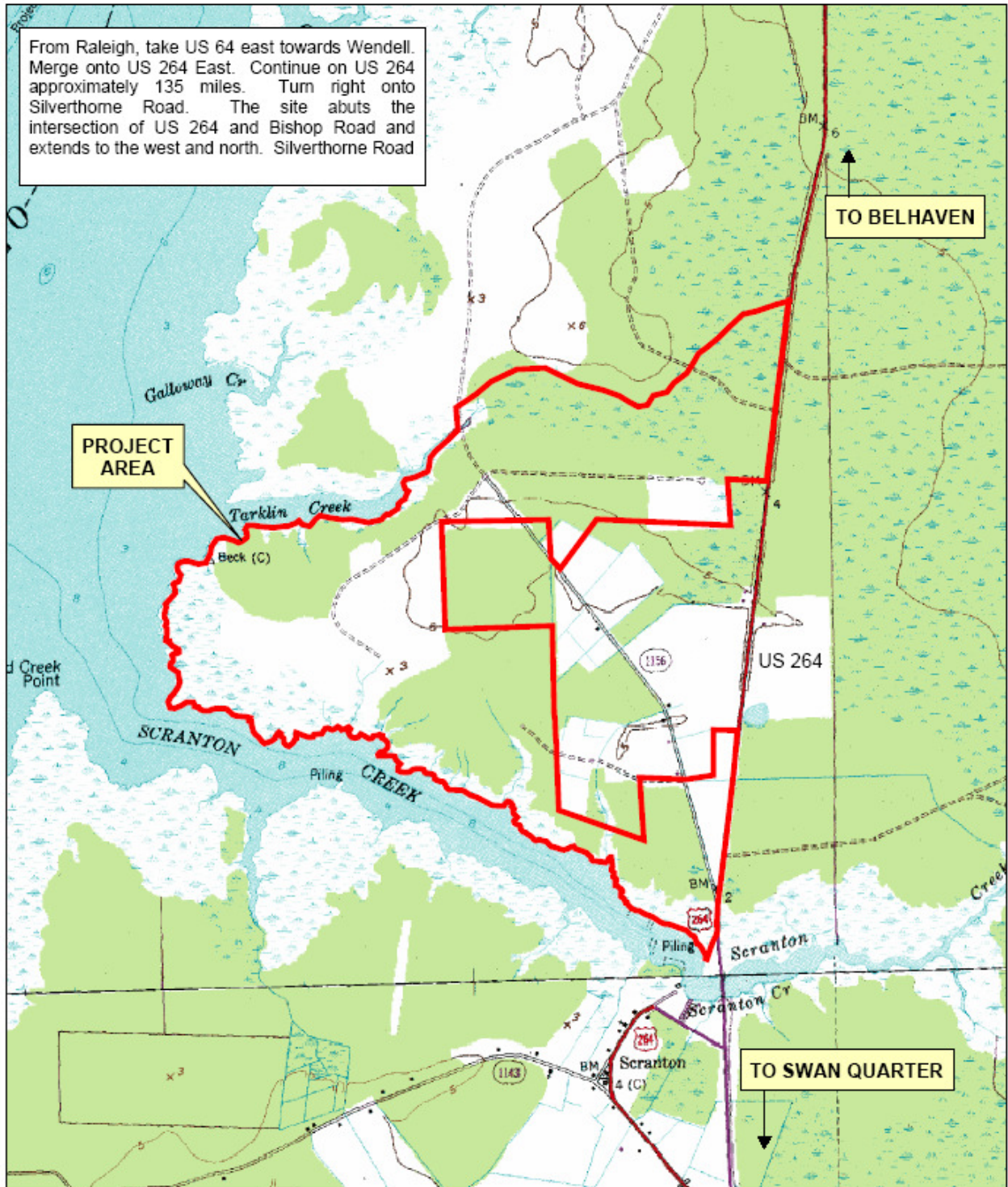
Level 3 plots are used to document the overall abundance and vertical distribution of leaf area cover of the more common species in a plot. Cover is estimated for all plant species exceeding a specified lower level (typically 5% cover); species present but with cover lower than the cut-off may be ignored. 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).

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.

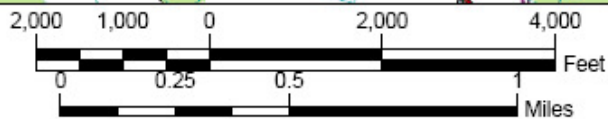
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- NC Department of Environment and Natural Resources, Ecosystem Enhancement Program (EEP), 2009. Final As-Built and Monitoring Baseline Report, Bishop Road Wetland Restoration, EEP IMS# 38, Hyde County, NC. Prepared by ARCADIS G&M of North Carolina, 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.
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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.

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:

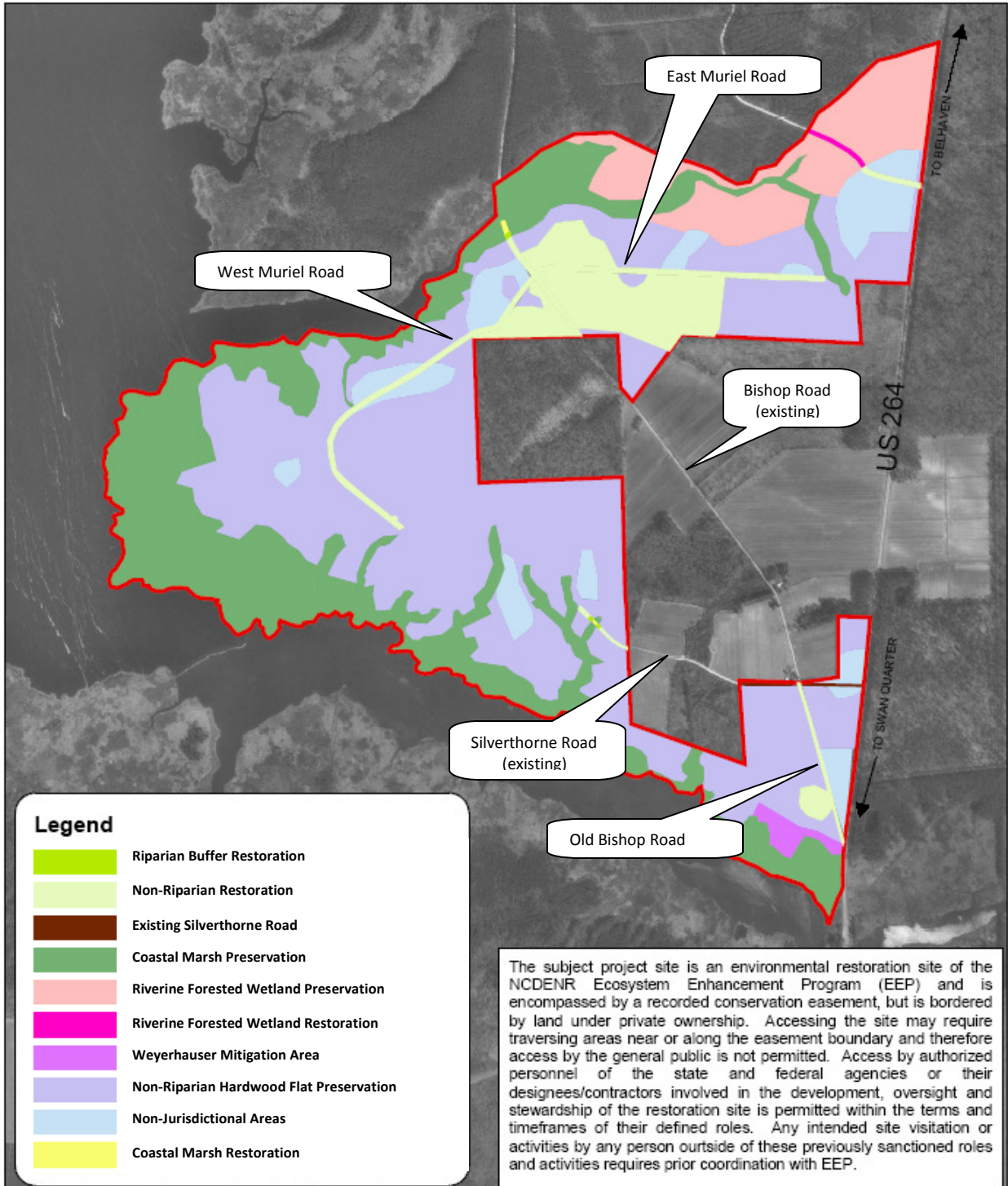



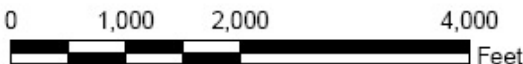


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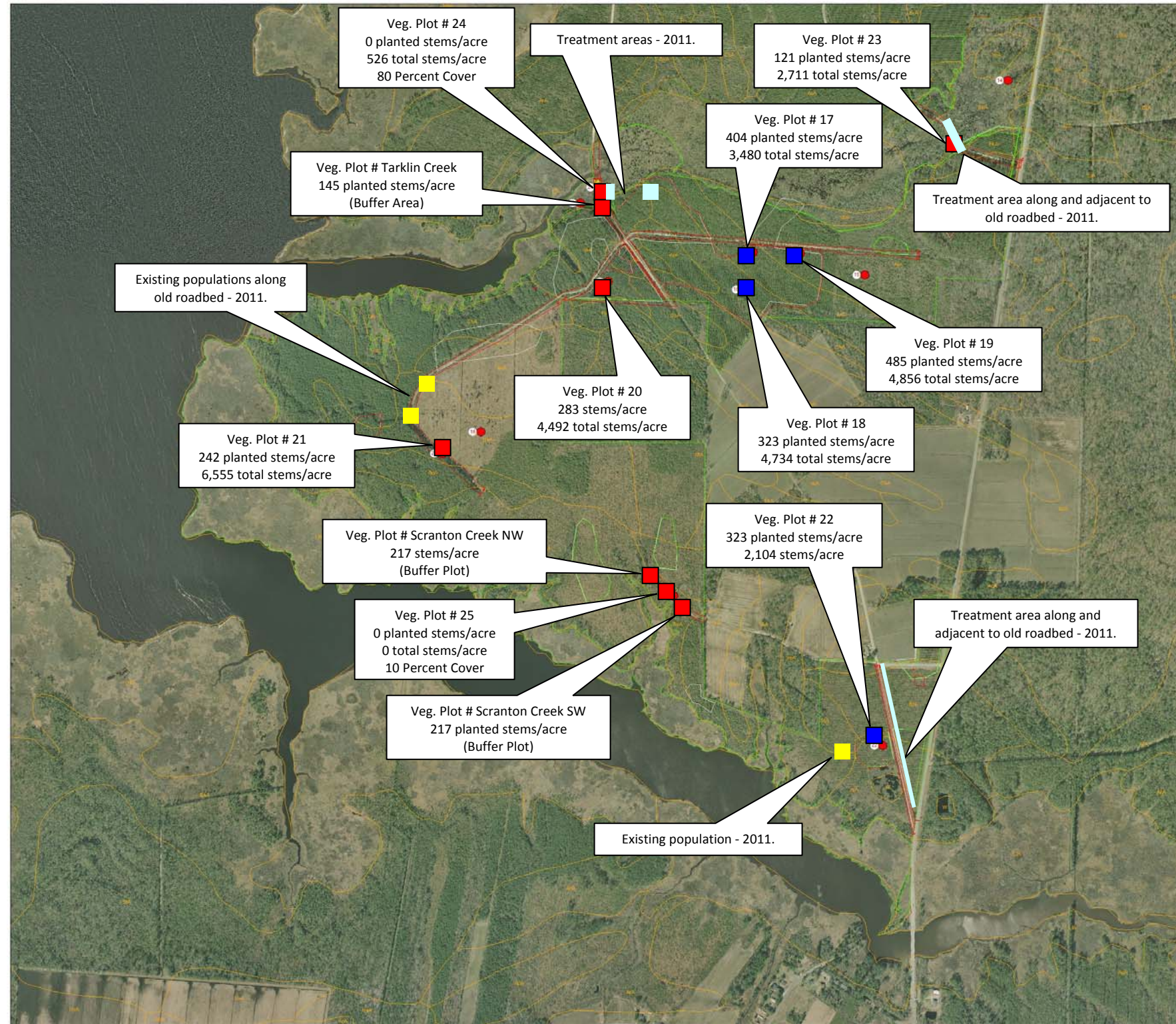


PROJECT SITE VICINITY MAP
Bishop Road Wetland Mitigation Site
HYDE COUNTY, NORTH CAROLINA

Figure No.
1



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



Bishop Road

Hyde County
2006 aerial photo
from CGIA

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



Key

- Vegetation Plots meeting mitigation expectations.
- Vegetation Plots requiring attention or not meeting current mitigation thresholds
- Common reed (*Phragmites australis*) treatment areas
- Existing populations of common reed (*Phragmites australis*)

0 65130 260 390 520 650 780 910 1,040

Meters

1 meter = 3.28 feet

khmillr 03/11/09



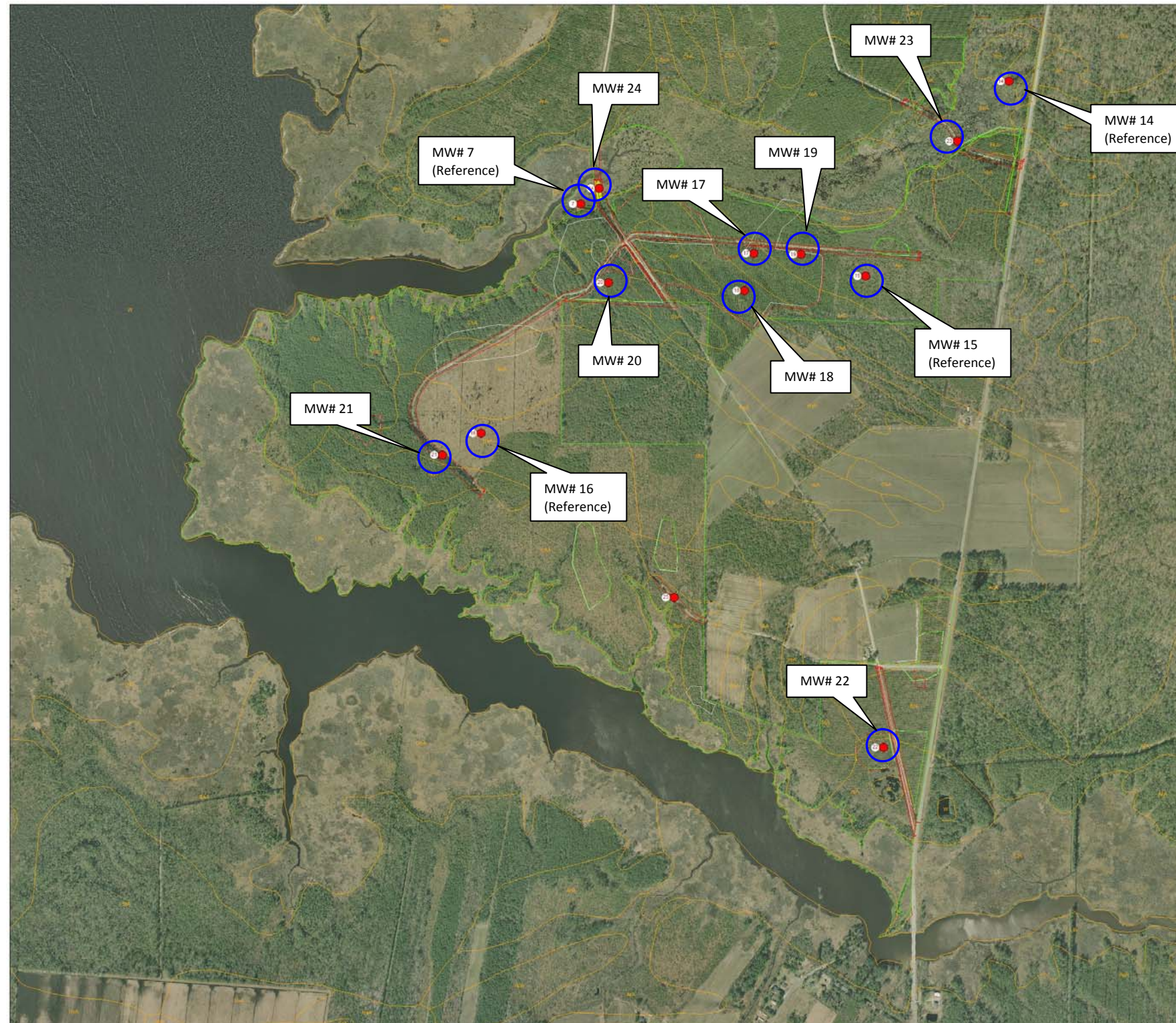
Vegetation Problem Areas Plan View
Monitoring Year 3 (2011) Assessment

Bishop Road Wetland Mitigation Site, Hyde County, NC

EEP Project No. 38

Source: Miller, 2009

Figure
3



Bishop Road

Hyde County
2006 aerial photo
from CGIA

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



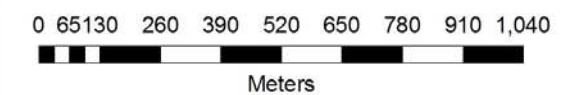
Key



Monitoring well met
2011 hydrology
criteria for mitigation.



Monitoring well did not
meet 2011 hydrology
criteria for mitigation
(Not Applicable)



1 meter = 3.28 feet

khmiller 03/11/09



Wetland Problem Areas Plan View
Monitoring Year 3 (2011) 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)

| | |
|--|---|
| Report Prepared By | Lane Sauls |
| Date Prepared | 10/24/2011 16:00 |
| database name | EcoEng-2011-A-38-BishopRoad-EntryTool-v227.mdb |
| database location | S:\Projects\50000 State\EEP 50512\50512-003 EEP Bishop Road\CVS DATA |
| computer name | LANE |
| file size | 79777792 |
| 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 Wetland Mitigation Site (EEP Project No. 38)

| | Species | CommonName | 4 | 3 | 2 | 1 | 0 | Missing | Unknown |
|----------------|------------------------------|--------------------|-----------|-----------|-----------|----------|----------|-----------|---------|
| | <i>Aronia arbutifolia</i> | Red Chokeberry | | | 1 | | | | |
| | <i>Baccharis halimifolia</i> | eastern baccharis | | 3 | 5 | | | | |
| | <i>Ilex glabra</i> | inkberry | | | 1 | | | | |
| | <i>Nyssa aquatica</i> | water tupelo | | | | | 1 | | |
| | <i>Quercus michauxii</i> | swamp chestnut oak | 1 | 1 | 1 | | | 2 | |
| | <i>Quercus pagoda</i> | cherrybark oak | 1 | 1 | 1 | | | | |
| | <i>Quercus phellos</i> | willow oak | 4 | 6 | 1 | | | | |
| | <i>Rosa palustris</i> | swamp rose | | 3 | | | | 8 | |
| | <i>Morella cerifera</i> | wax myrtle | 8 | 5 | 1 | | | | |
| | <i>Ilex opaca</i> | American holly | | | 1 | | | 1 | |
| | <i>Quercus</i> | oak | 1 | 8 | 3 | 2 | | 18 | |
| | <i>Magnolia virginiana</i> | sweetbay | | 1 | | | 1 | 1 | |
| | <i>Myrica</i> | sweetgale | | | | | | 6 | |
| | <i>Nyssa</i> | tupelo | | | 1 | | | | |
| | <i>Salix</i> | willow | 1 | | | | | | |
| | <i>Unknown</i> | | | | | | | 2 | |
| TOTALS: | 16 | 15 | 16 | 28 | 16 | 2 | 2 | 38 | |

Source: CVS-EEP Data Output

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) | Game | Unknown | Vine Strangulation | |
|------------------------------|--------------------|----------------------------|-------------|-----------|----------|--------------------|----------|
| <i>Aronia arbutifolia</i> | Red Chokeberry | 1 | | 1 | | | |
| <i>Baccharis halimifolia</i> | eastern baccharis | 5 | 3 | | 5 | | |
| <i>Ilex glabra</i> | inkberry | 1 | | 1 | | | |
| <i>Ilex opaca</i> | American holly | 1 | 1 | | 1 | | |
| <i>Magnolia virginiana</i> | sweetbay | 1 | 2 | | 1 | | |
| <i>Morella cerifera</i> | wax myrtle | 1 | 13 | | 1 | | |
| <i>Myrica</i> | sweetgale | 0 | 6 | | | | |
| <i>Nyssa</i> | tupelo | 1 | | 1 | | | |
| <i>Nyssa aquatica</i> | water tupelo | 1 | 1 | | 1 | | |
| <i>Quercus</i> | oak | 6 | 26 | 1 | 4 | 1 | |
| <i>Quercus michauxii</i> | swamp chestnut oak | 1 | 4 | | 1 | | |
| <i>Quercus pagoda</i> | cherrybark oak | 1 | 2 | | 1 | | |
| <i>Quercus phellos</i> | willow oak | 1 | 10 | 1 | | | |
| <i>Rosa palustris</i> | swamp rose | 1 | 10 | 1 | | | |
| <i>Salix</i> | willow | 0 | 1 | | | | |
| <i>Unknown</i> | | 0 | 2 | | | | |
| TOTALS: | 16 | 15 | 22 | 81 | 6 | 15 | 1 |

Source: CVS-EEP Data Output

Appendix A Table 4. Vegetation Damage by Plot

Bishop Road Wetland Mitigation Site (EEP Project No. 38)

| plot | Count of Damage Categories | | | | | | |
|-----------------------------|----------------------------|--------------------|-----------|----------|--------------------|-----------|----------|
| | (no damage) | (no stems on plot) | Game | Unknown | Vine Strangulation | | |
| E38-1-Gauge17-year:3 | 2 | 8 | | 1 | | 1 | |
| E38-1-Gauge18-year:3 | 2 | 7 | | 1 | 1 | | |
| E38-1-Gauge19-year:3 | 4 | 9 | | 3 | 1 | | |
| E38-1-Gauge20-year:3 | 1 | 11 | | 1 | | | |
| E38-1-Gauge21-year:3 | 1 | 6 | | | 1 | | |
| E38-1-Gauge22-year:3 | 5 | 3 | | | 5 | | |
| E38-1-Gauge23-year:3 | 2 | 11 | | | 2 | | |
| E38-1-Gauge24-year:3 | 0 | 7 | | | | | |
| E38-1-Gauge25-year:3 | | | 1 | | | | |
| E38-EEP-NWScranton-year:2 | 2 | 7 | | | 2 | | |
| E38-EEP-SWScranton-year:2 | 1 | 4 | | | 1 | | |
| E38-EEP-TarklinCreek-year:2 | 2 | 8 | | | 2 | | |
| TOTALS: | 12 | 22 | 81 | 1 | 6 | 15 | 1 |

Source: CVS-EEP Data Output

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 | | avg# stems | Plot | | | | | | | | | | | | |
|----------------|------------------------------|--------------------|---------------------|-----------|------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|-----------------------|-----------------------|-------------------------|----------|
| | | | # | plots | | E38-1-Gauge17-Year:3 | E38-1-Gauge18-Year:3 | E38-1-Gauge19-Year:3 | E38-1-Gauge20-Year:3 | E38-1-Gauge21-Year:3 | E38-1-Gauge22-Year:3 | E38-1-Gauge23-Year:3 | E38-1-Gauge24-Year:3 | E38-1-Gauge25-Year:3 | EEP-NWScranton-year:2 | EEP-SWScranton-year:2 | EEP-TarklinCreek-year:2 | |
| | <i>Aronia arbutifolia</i> | Red Chokeberry | 1 | 1 | 1 | | | 1 | | | | | | | | | | |
| | <i>Baccharis halimifolia</i> | eastern baccharis | 8 | 1 | 8 | | | | | | | 8 | | | | | | |
| | <i>Ilex glabra</i> | inkberry | 1 | 1 | 1 | | | 1 | | | | | | | | | | |
| | <i>Ilex opaca</i> | American holly | 1 | 1 | 1 | | 1 | | | | | | | | | | | |
| | <i>Magnolia virginiana</i> | sweetbay | 1 | 1 | 1 | 1 | | | | | | | | | | | | |
| | <i>Morella cerifera</i> | wax myrtle | 14 | 7 | 2 | 3 | 4 | 2 | 1 | 1 | | 2 | | | | | 1 | |
| | <i>Nyssa</i> | tupelo | 1 | 1 | 1 | 1 | | | | | | | | | | | | |
| | <i>Quercus</i> | oak | 14 | 7 | 2 | 1 | 2 | 1 | | 4 | | | | | | 3 | 1 | 2 |
| | <i>Quercus michauxii</i> | swamp chestnut oak | 3 | 3 | 1 | | 1 | 1 | | | | | | | | | 1 | |
| | <i>Quercus pagoda</i> | cherrybark oak | 3 | 1 | 3 | | | 3 | | | | | | | | | | |
| | <i>Quercus phellos</i> | willow oak | 11 | 4 | 2.75 | 4 | | 3 | 3 | 1 | | | | | | | | |
| | <i>Rosa palustris</i> | swamp rose | 3 | 1 | 3 | | | | | 3 | | | | | | | | |
| | <i>Salix</i> | willow | 1 | 1 | 1 | | | | | | | | 1 | | | | | |
| | n/a: no stems | | 0 | 2 | | | | | | | | | | 0 | 0 | | | |
| TOTALS: | 1 | 13 | 13 | 62 | 14 | | 10 | 8 | 12 | 7 | 6 | 8 | 3 | 0 | 0 | 3 | 3 | 2 |

Source: CVS-EEP Data Output

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 | |
| 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

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

Photo #
VP-22 Facing
West



Photo #
VP-23 Facing
North

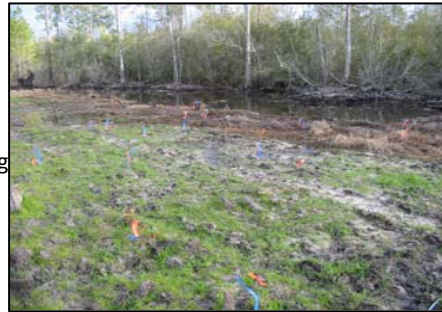


Photo #
VP-24 Facing
North



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

Photo #
Scranton SE
Facing
Northwest



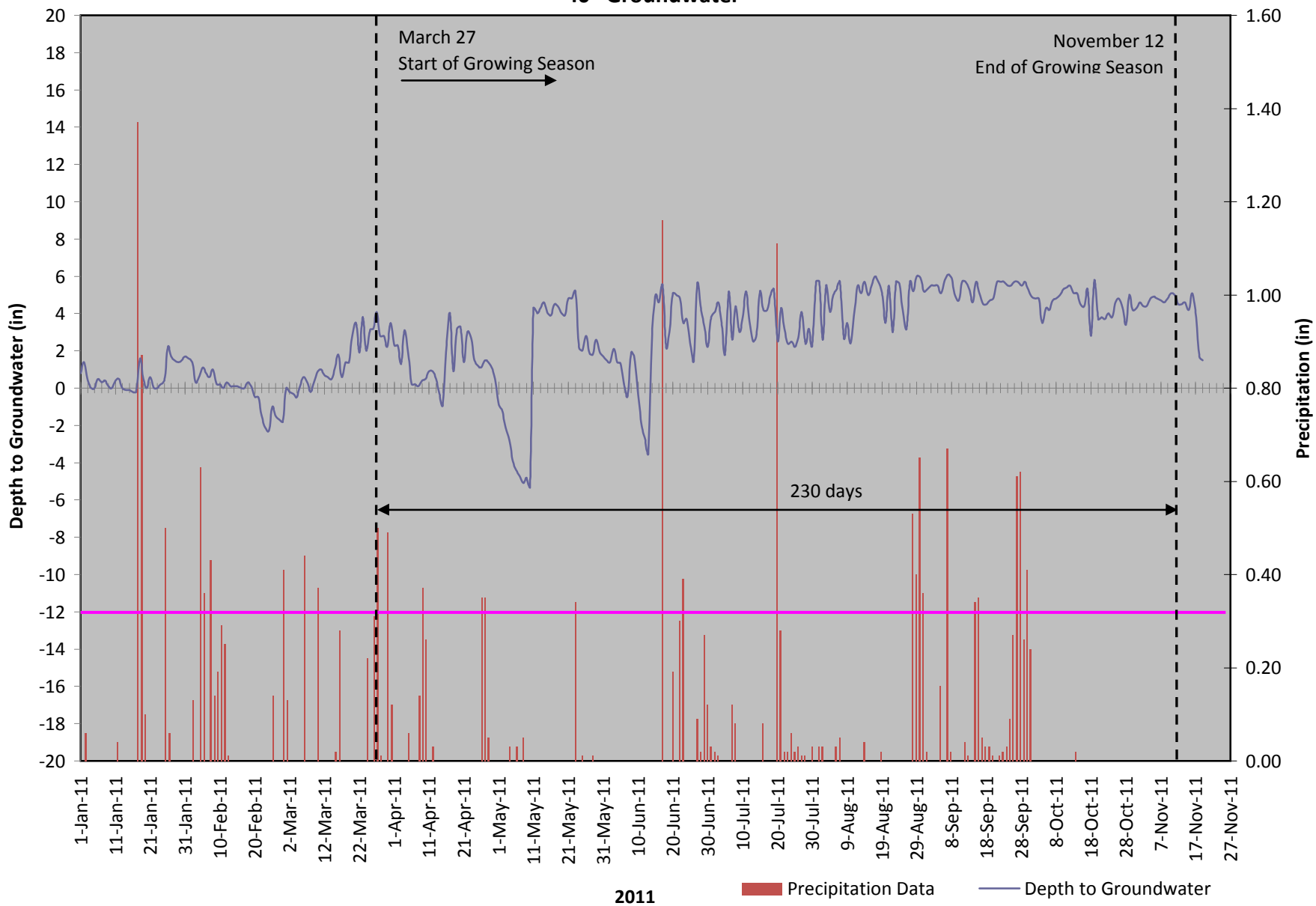
Photo #
Tarklin
Creek S
Facing South



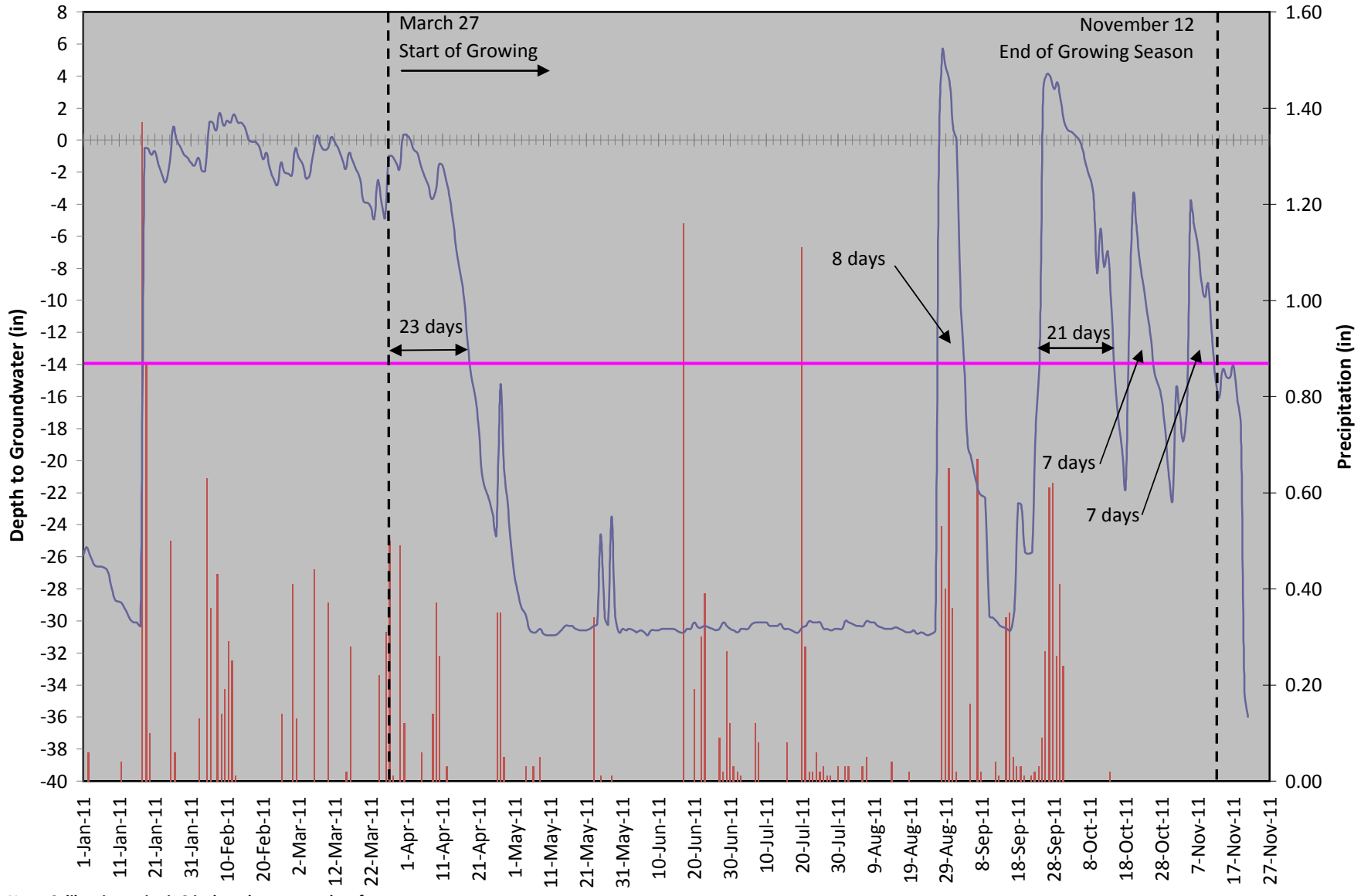
Appendix B

Wetland Raw Data

Monitoring Well #7 (Reference) 40" Groundwater



Monitoring Well #14 (Reference) 40" Groundwater



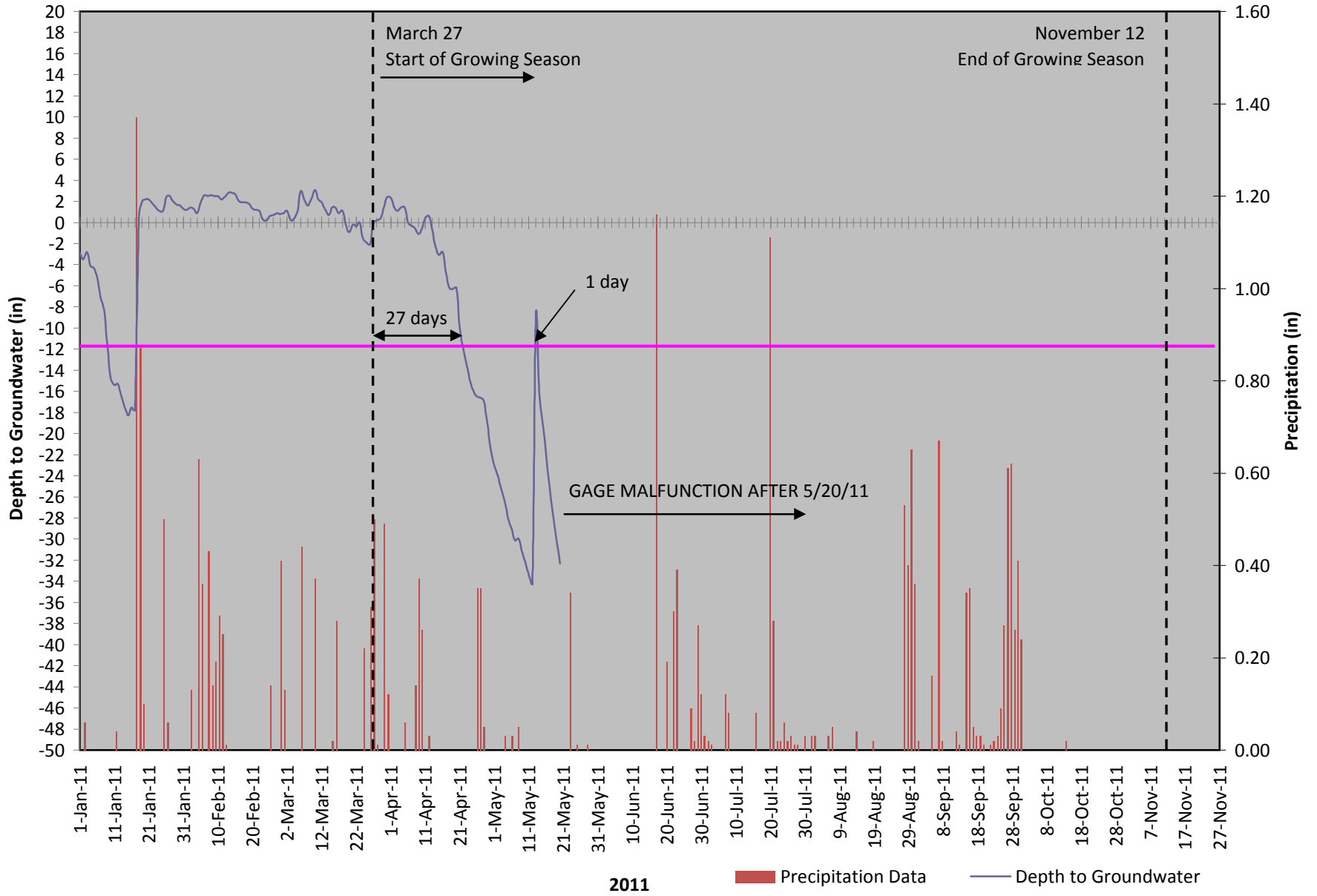
Note: Calibration point is 2 inches above ground surface

2011

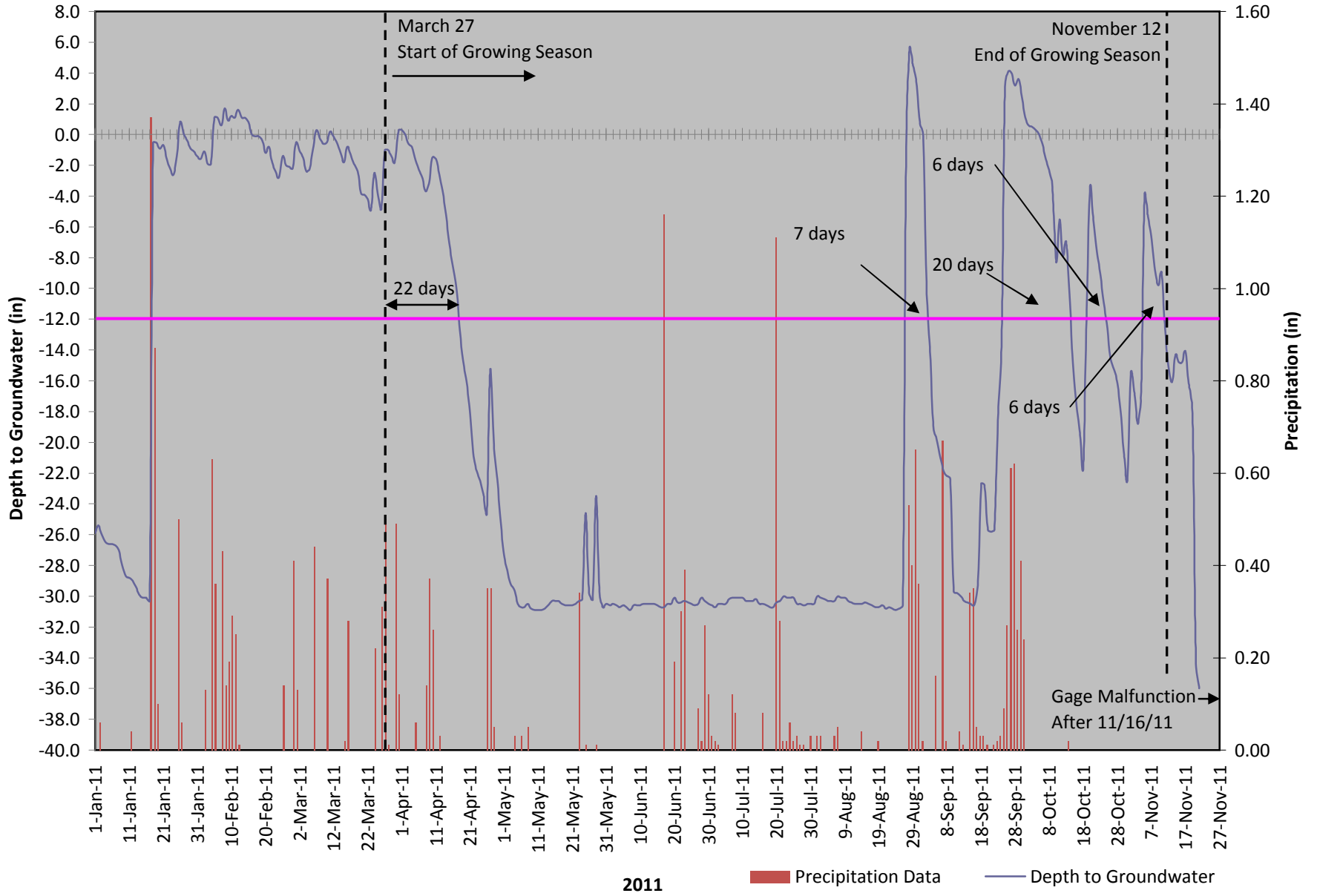
■ Precipitation Data

— Depth to Groundwater

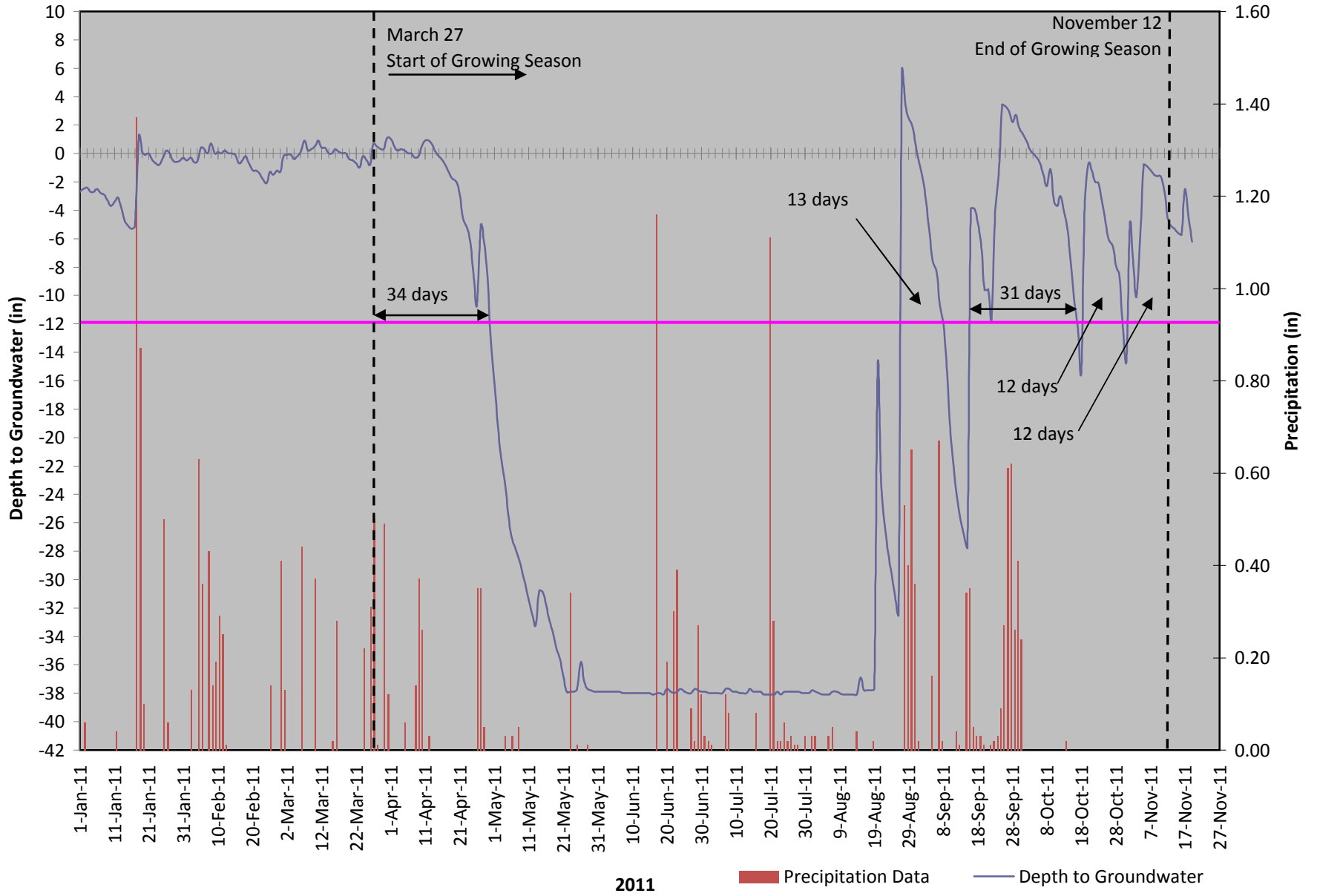
Monitoring Well #15 (Reference) 40" Groundwater



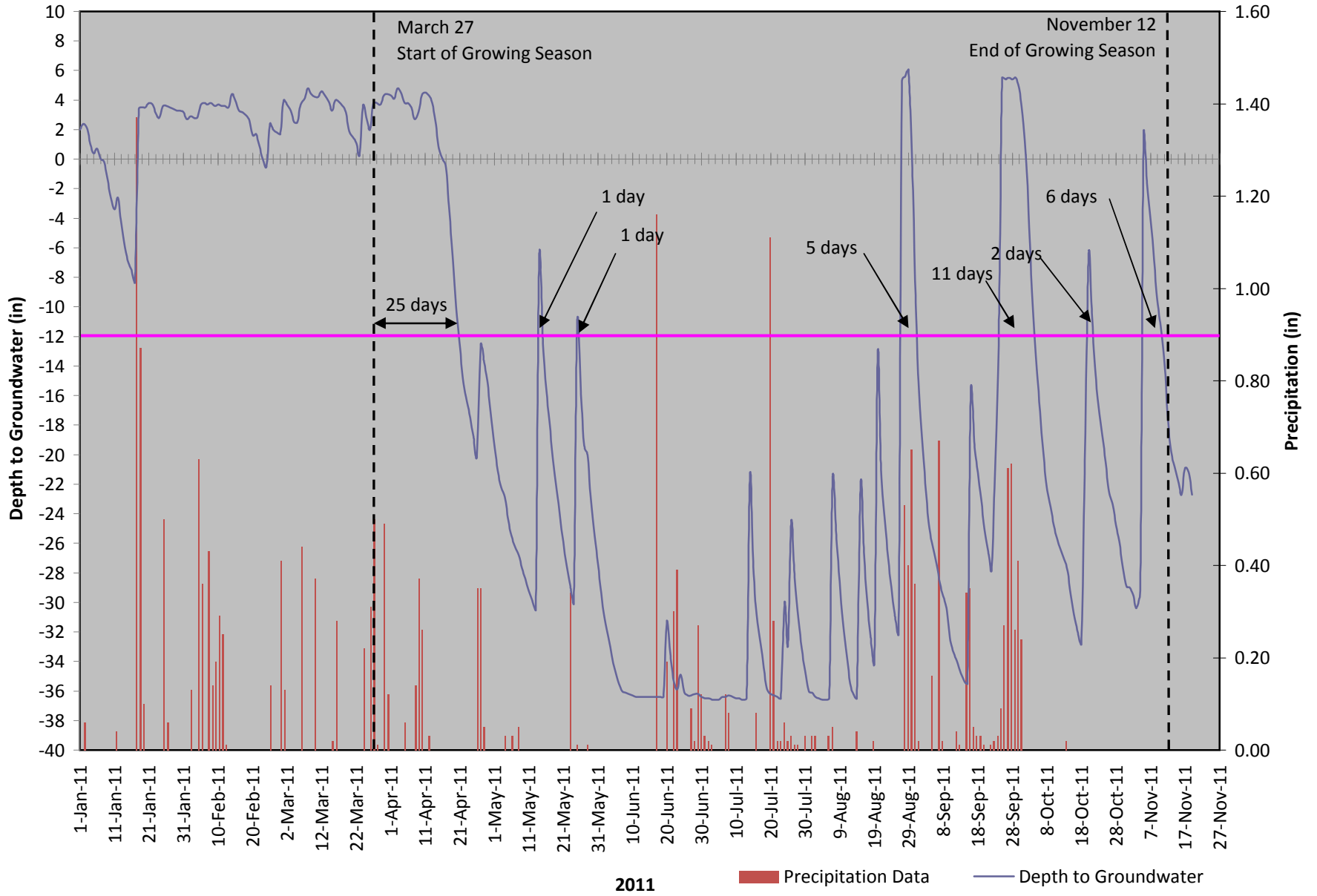
Monitoring Well #16 (Reference) 40" Groundwater



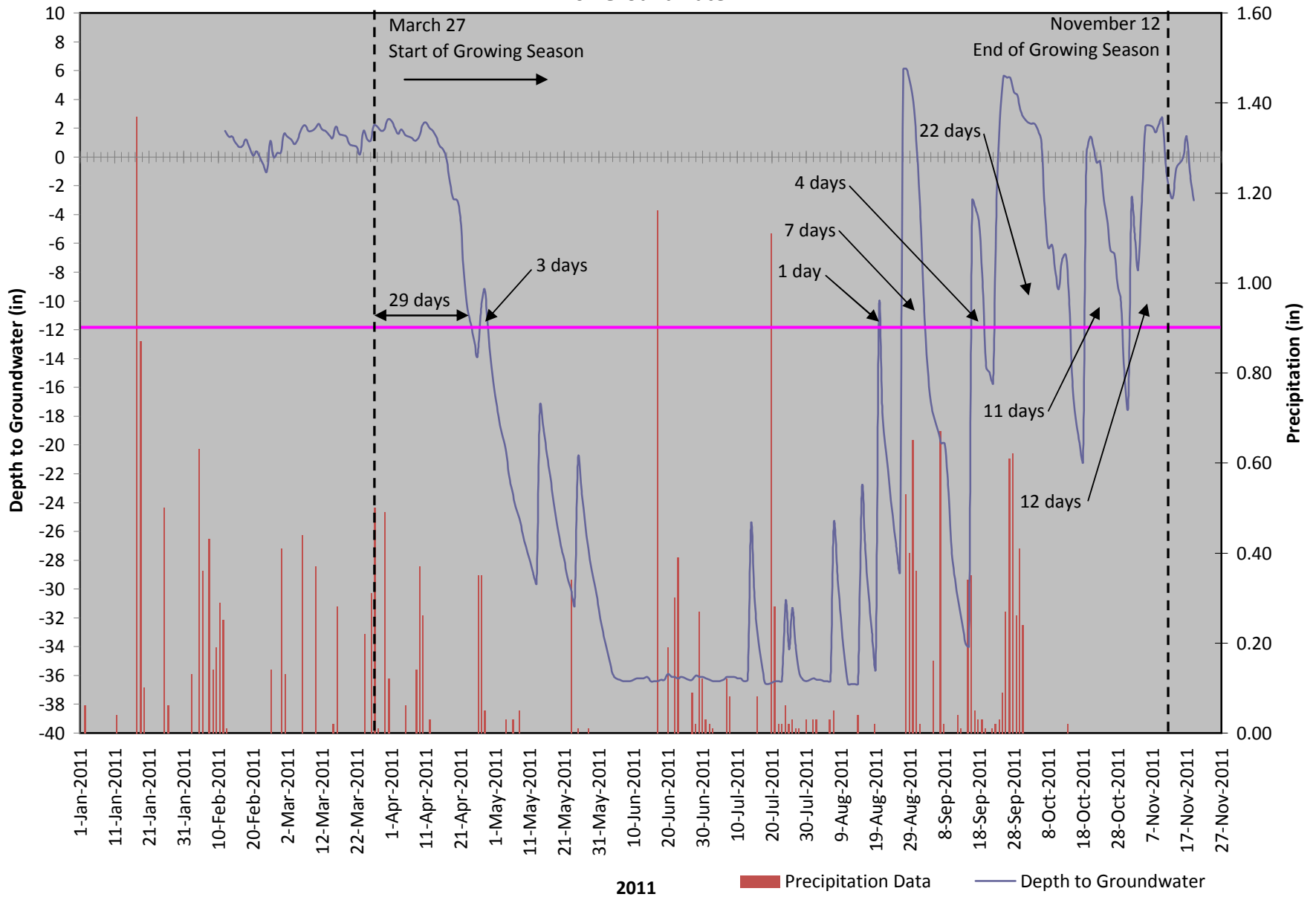
Monitoring Well #17 40" Groundwater



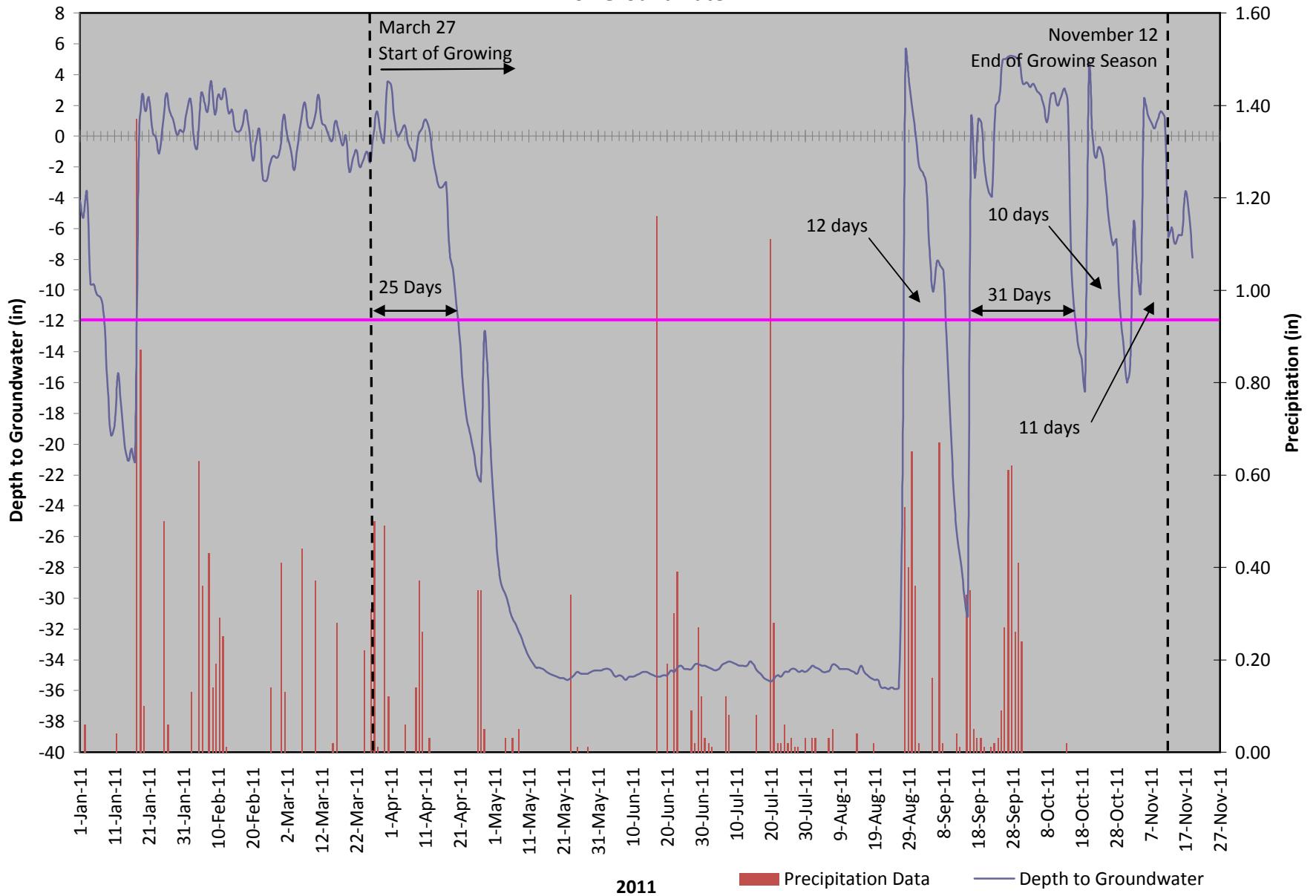
Monitoring Well #18 40" Groundwater



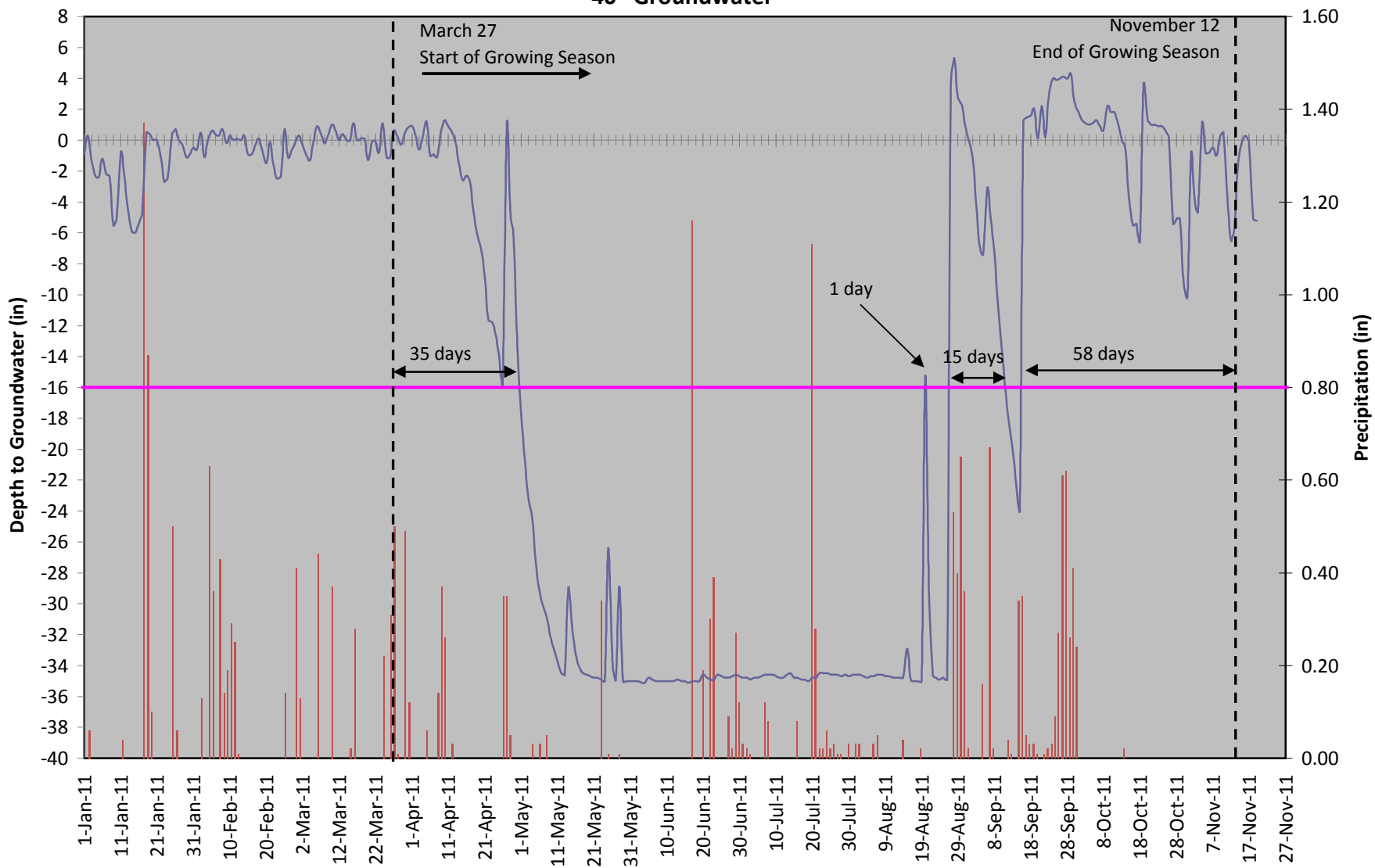
Monitoring Well #19 40" Groundwater



Monitoring Well #20 40" Groundwater



Monitoring Well #21 40" Groundwater



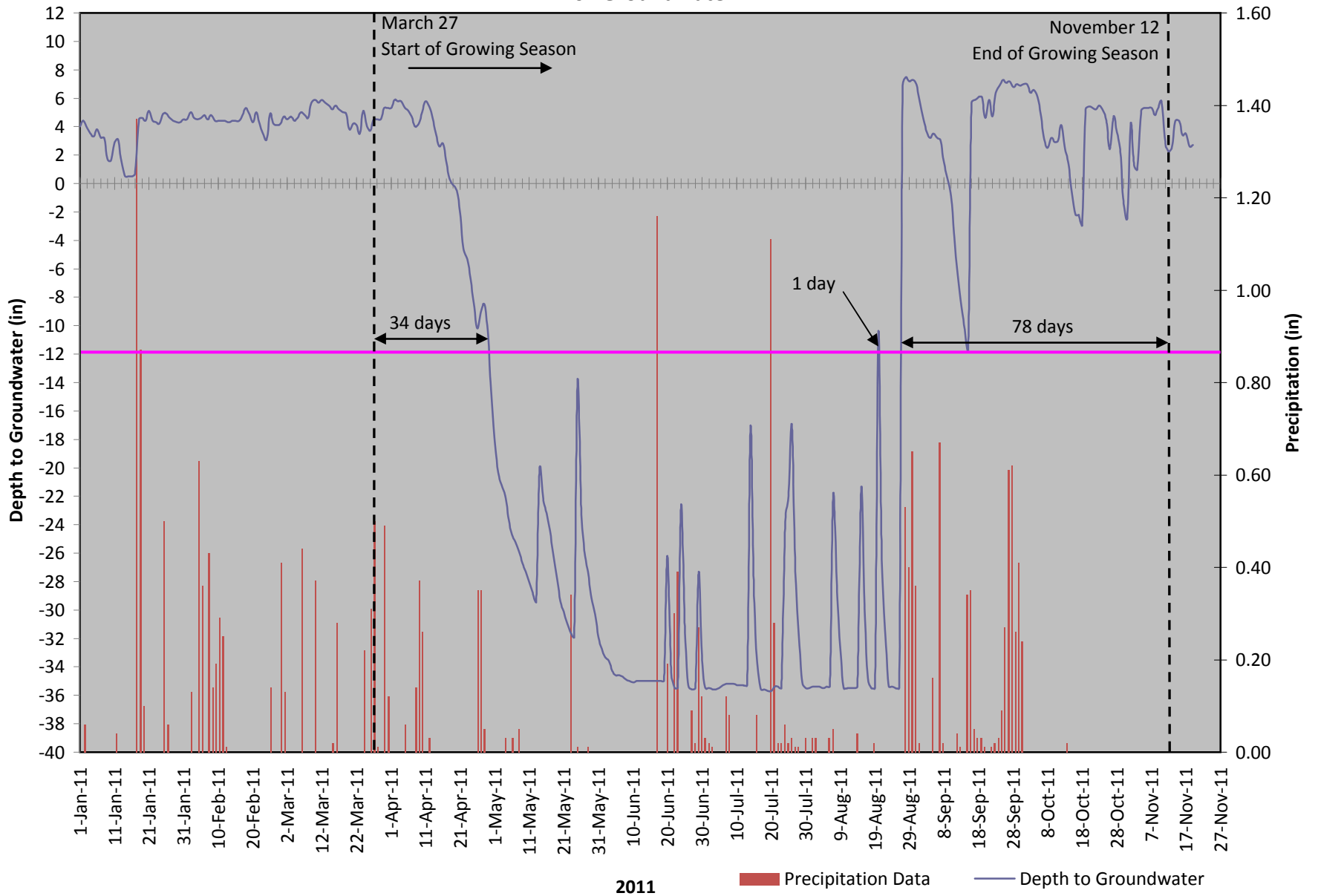
Note: Calibration point is 4 inches above ground surface

2011

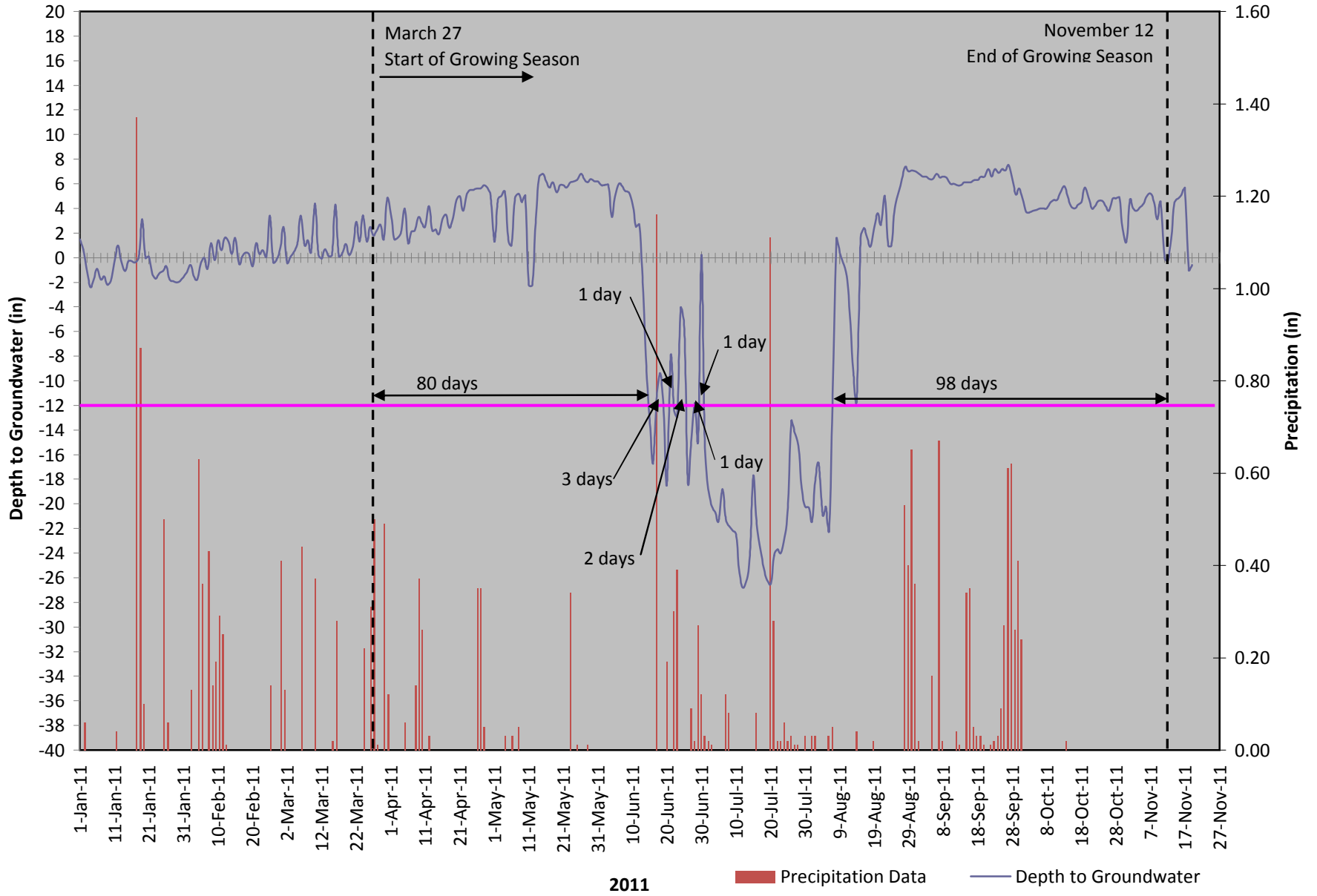
■ Precipitation Data

— Depth to Groundwater

Monitoring Well #22 40" Groundwater



Monitoring Well #23 40" Groundwater

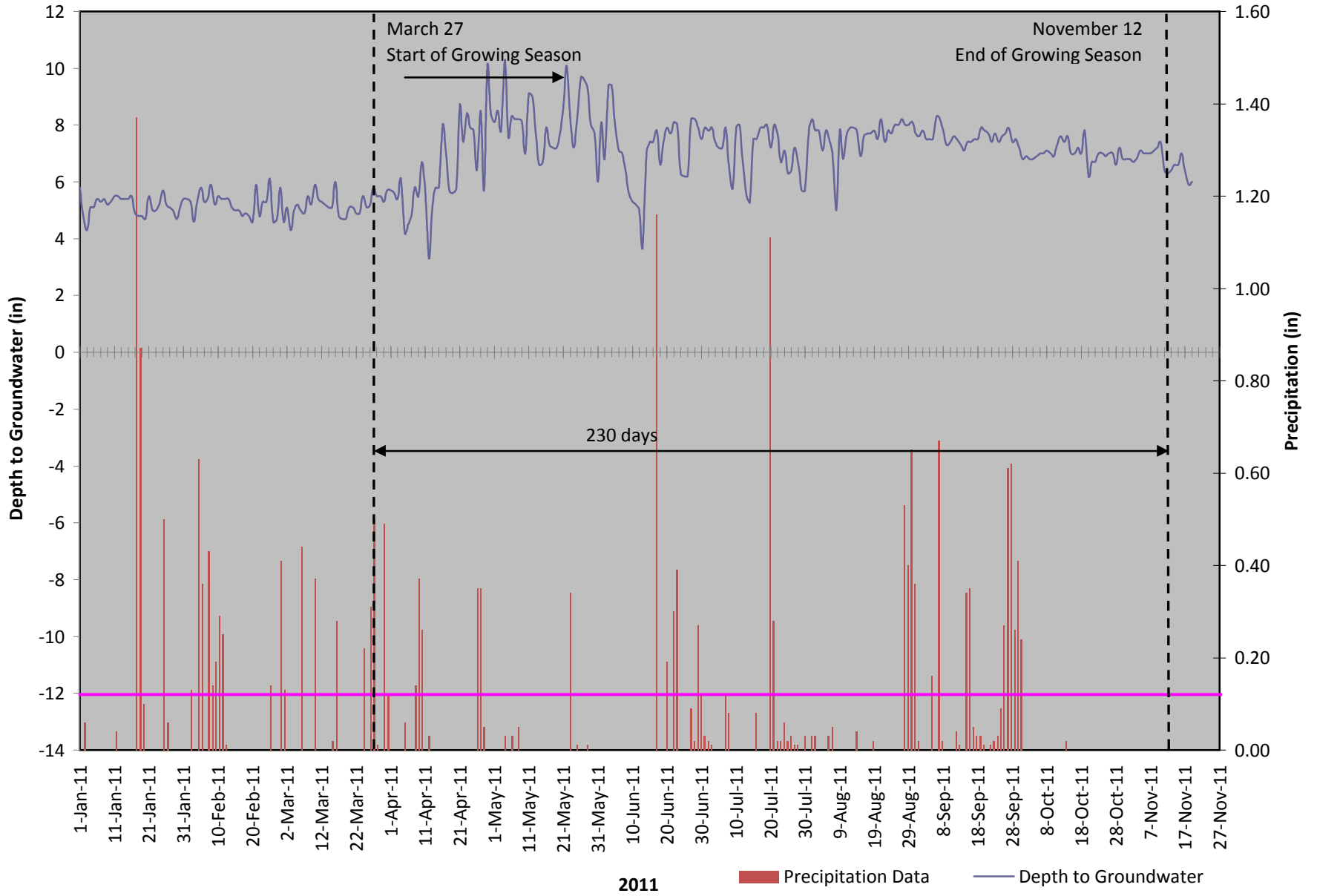


2011

■ Precipitation Data

— Depth to Groundwater

Monitoring Well #24 40" Groundwater



2011

■ Precipitation Data — Depth to Groundwater