ANNUAL MONITORING REPORT
HOWELL WOODS

WETLAND RESTORATION
JOHNSTON COUNTY, NORTH CAROLINA
(EEP Project Number 183)

Monitoring Year 7 of 7 (2008)

Submitted to:
North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program
Raleigh, North Carolina

December 2008

ANNUAL MONITORING REPORT
HOWELL WOODS

WETLAND RESTORATION
JOHNSTON COUNTY, NORTH CAROLINA
(EEP Project Number 183)

Monitoring Year 7 of 7 (2008)

Submitted to:
North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program
Raleigh, North Carolina

Prepared by/Monitoring Performer:
Axiom Environmental, Inc.
2126 Rowland Pond Drive
Willow Spring, North Carolina 27592

Design Firm:
EcoScience Corporation
1101 Haynes Street, Suite 101
Raleigh, North Carolina 27592

Axiom Environmental, Inc.

Ecosystem Enhancement PROGRAM

December 2008

EXECUTIVE SUMMARY

The Howell Woods Wetland Restoration Site (Site) is located within the United States Geological Survey (USGS) Hydrologic Unit 03020201 (North Carolina Division of Water Quality [NCDWQ] subbasin 03-04-04) of the Neuse River Basin. The Site includes an approximately 140-acre tract, located approximately 8.5 miles southeast of the Town of Smithfield in southern Johnston County (Figure 1). The Site is contained within an approximately 2000-acre tract of land managed by Johnston County Community College as part of the Howell Woods Environmental Learning Center.

The primary goals of the project included the following.

1. Enhance water quality functions in the Gar Gut Creek and Mill Creek watersheds.
2. Reestablish a functioning backwater slough system, which extends through developing bottomland hardwood forests.
3. Provide educational opportunities to show the importance of wetlands for water quality.
4. Maximize the area returned to historic wetland function.

Five vegetation plots had been previously established by North Carolina State University. The plots are 10 meters square and are located randomly within the Site. Results from vegetation surveys exceeded success criteria with 346, 1806, 1401, and 1101 planted stems per acre present in years 2 through 5, respectively; with an increase in species diversity over the monitoring period. No data was available for year 1 monitoring.

No vegetation or wetland problem areas were identified during the year 7 (2008) monitoring year. All gauges are currently functioning and recorded groundwater hydrology within 12 inches of the ground surface for at least 5 percent of the growing season with a presence of hydrophytic vegetation. Groundwater hydrology at the Site will be monitored for one more growing season of 2009 during year 8.

In summary, the Site achieved success criteria for hydrology and vegetation in the Seventh Monitoring Year (2008). In addition, based on available data the Site achieved success criteria for hydrology and vegetation over the entire 7-year monitoring period.

Table of Contents

List of Figures

List of Tables

Appendices

1.0 PROJECT BACKGROUND

1.1 Location and Setting

The Howell Woods Wetland Restoration Site (Site) is located within the United States Geological Survey (USGS) Hydrologic Unit 03020201 (North Carolina Division of Water Quality [NCDWQ] subbasin 03-04-04) of the Neuse River Basin. The Site includes an approximately 140-acre tract, located approximately 8.5 miles southeast of the Town of Smithfield in southern Johnston County (Figure 1). The Site is contained within an approximately 2000-acre tract of land managed by Johnston County Community College as part of the Howell Woods Environmental Learning Center.

Directions to the Site:
From Highway 70 Business in Smithfield

- Travel south on Route 701 for approximately 15 miles
- Turn left/southeast on Devil's Racetrack Road for approximately 10 miles
- Turn left into the Howell Woods Environmental Learning Center
- See Jaime Sasser or Kinchon Taylor at the Center office for a gate key and directions into the Site

The Site is located in the Southeastern Plains Physiographic Province, within the Southeastern Floodplains and Low Terraces ecoregion and is immediately east of the fall line of the Coastal Plain and Piedmont regions of North Carolina.

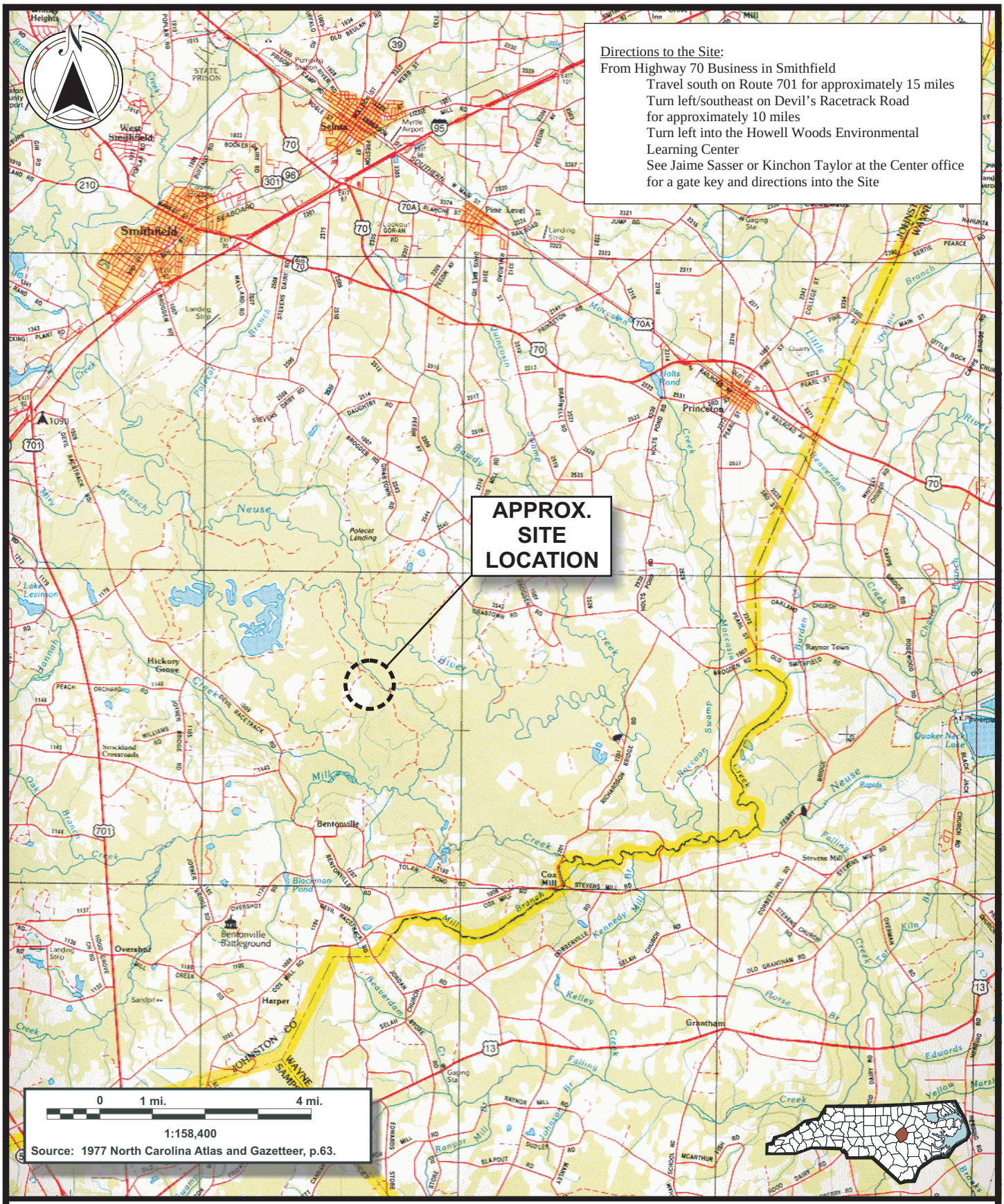
The Site is situated within the Gar Gut watershed (slough-like tributary to the Neuse River) in the outer perimeter of the Neuse River floodplain at the base of the escarpment between the Neuse River floodplain and an elevated river terrace. Ponded depressions, swamps, and sloughs occur throughout the 3.5-mile wide floodplain and are characterized by cypress-gum associations. Elevated, well-drained portions of the floodplain support bottomland hardwood and mesic upland slope forests dominated by oaks and ashes.

1.2 Mitigation Structure and Objectives

Prior to implementation of wetland restoration activities, the Site was characterized by agriculture, fallow fields, and forest. Land use activities in the drainage area and adjacent tracts are limited due to frequent flooding from the Neuse River and poorly drained soils. Onsite land use was characterized by farming (agricultural row crops), hunting, and recreational activities associated with the Howell Woods Environmental Learning Center.

The primary restoration feature at the Site included 5400 linear feet of a dredged and straightened canal and associated ditch network system that drained the majority of the Site. The canal was dredged along the toe of slope at the outer floodplain edge. This area historically supported a backwater slough, as evidenced by relict channel reaches within forested sections of the Site situated adjacent to the excavated canal.

Wetland/backwater slough restoration at the Site entailed 1) ditch cleaning prior to backfill, 2) impervious ditch plug construction, 3) ditch/canal backfilling, 4) access road improvements, 5) littoral shelf creation, and 6) pond outfall structural upgrades. In addition to hydrology alterations associated with ditch backfilling, a primary component of the project entailed restoring surface water flows through the abandoned backwater slough channel.



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

SITE LOCATION
HOWELL WOODS RESTORATION SITE
Project Number 183
Year 7 (2008) Monitoring Report
Johnston County, North Carolina

Dwn. by:	CLF
Ckd by:	WGL
Date:	Sept 2008
Project:	08-001

FIGURE
1

Based on an October 2001 Detailed Wetland Restoration Plan, the primary goals of the project included 1) maximizing the area returned to historic wetland function, 2) enhancing the water quality functions in Gar Gut Creek and Mill Creek, and 3) reestablishing a functioning backwater slough system, which extends through developing bottomland hardwood forests. Project structures and objectives are summarized in Tables 1 and 2.

Table 1. Project Mitigation Structures and Objectives

Project Name/Number: Howell Woods (EEP Project Number 183)

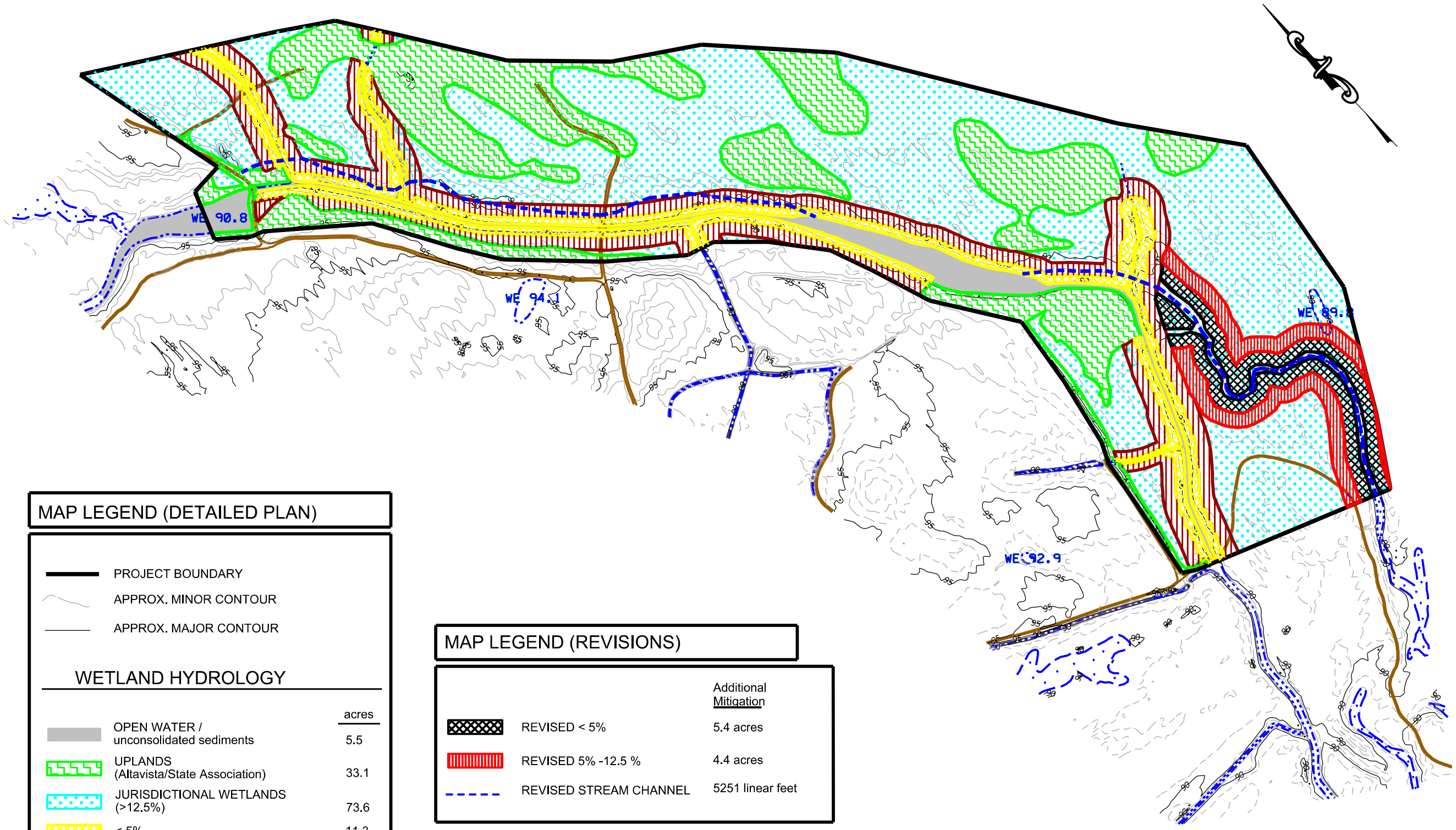
Project Segment or Reach ID	Mitigation Type**	Approach	Linear Footage or Acreage	Revised Linear Footage or Acreage	Stationing	Comment
Howell Woods	R	---	24 acres	34 acres	---	Areas Effectively Drained by Historic Ditch/Canal
Howell Woods	E	---	74 acres	64 acres	---	Areas with Hydrology Effected by Ditches/Canal, but not Drained Below Jurisdictional Threshold
Howell Woods	C	---	4 acres	4 acres	---	Littoral Shelf Excavation
Howell Woods	R	---	--	5251 feet	*	Passive Backwater Slough Restoration

* No stationing along the reach, linear footage is based on down valley distance of the braided stream channel, as based on inter agency guidance (USACE et. al. 2005)

**R = Restoration
E = Enhancement
C = Creation

At the time of project completion, stream restoration projects entailed traditional alterations to channel dimension, pattern, and profile, as outlined in *Applied River Morphology* (Rosgen 1996). However, recent guidance (USACE et al. 2005) for the restoration of backwater sloughs in low-slope settings (outer Coastal Plain) indicates that stream restoration may be achieved through the reestablishment of braided stream morphology through passive measures, including ditch filling and natural progression of the stream through historic sloughs, braids, and channels. Under this scenario, stream restoration success criteria may include the successful restoration of hydrology within areas previously drained by ditching or other hydrology alterations. Using this guidance, approximately 5251 linear feet of backwater slough stream channel has been restored within the Site (Figure 2).

Wetland restoration acreages and locations were determined in the October 2001 Detailed Wetland Restoration Plan. Wetland restoration areas were defined as portions of the Site that were hydrologically impacted (hydrology below 12 inches of the ground surface for most of the growing season) by drainage ditch excavation. Wetland restoration areas were determined utilizing DRAINMOD computer simulations to predict the effect Site drainage features had on the adjacent groundwater table. However, the abandoned backwater slough channel, which served as an approximately 2 to 3 foot deep drainage feature prior to restoration activities, was not included in the original DRAINMOD model simulations. Utilizing drainage effect estimates from the October 2001 Detailed Wetland Restoration Plan, the abandoned backwater slough channel drained an additional 10 acres of wetland at the Site prior to restoration activities. These revised acreages are depicted on Figure 2 and are described in Table 1 (Project Mitigation Structures and Objectives).



MAP LEGEND (DETAILED PLAN)

- PROJECT BOUNDARY
- APPROX. MINOR CONTOUR
- APPROX. MAJOR CONTOUR

WETLAND HYDROLOGY

	acres
OPEN WATER / unconsolidated sediments	5.5
UPLANDS (Altavista/State Association)	33.1
JURISDICTIONAL WETLANDS (>12.5%)	73.6
< 5%	11.3
5%-12.5%	16.5
Total	140.0

MAP COMPILED BY PHOTOGRAMMETRIC METHODS.

MAP LEGEND (REVISIONS)

	Additional Mitigation
REVISED < 5%	5.4 acres
REVISED 5% -12.5 %	4.4 acres
REVISED STREAM CHANNEL	5251 linear feet

250 0 250 500 750
SCALE IN FEET

Axiom Environmental, Inc.

REVISIONS

Client:
WETLANDS RESTORATION PROGRAM
Raleigh, North Carolina

Project:
HOWELL WOODS RESTORATION SITE
Project Number 183
Year 7 (2008 Monitoring Report)
JOHNSTON COUNTY, NORTH CAROLINA

Title:
DRAINMOD
REVISED MITIGATION UNIT CALCULATIONS

Dwn By:	Date:
WGL	Sept 2008
Ckd By:	Scale:
WGL	1"= 500'

AXE Project No.: 06-002

FIGURE
2

1.3 Project History and Background

In the spring of 1999, a preliminary feasibility study was conducted at the Site, which included the following activities: 1) property boundary surveys, 2) aerial photography and topographic mapping, 3) soil mapping, 4) hydraulic conductivity estimates, 5) groundwater and surface water elevation monitoring, and 6) planting plan development. A feasibility report was prepared in April 1999 that described the results of these studies and presented mitigation options for the Site.

A mitigation alternatives analysis was subsequently conducted in the spring of 2000. The alternatives analysis outlined five mitigation options for the Site. These mitigation options included 1) no action, 2) stream restoration on new location, 3) in-canal structures and ford construction, 4) in-canal structures and road elevation, and 5) backwater slough/passive stream restoration.

In March 2000 approximately 19 acres of agricultural fields within the Site were revegetated with native, wetland-adapted tree species. Approximately 9600 tree seedlings were purchased and planted on 10 foot centers. Monitoring of planted species occurred in the fall of 2001.

In an effort to expand the Site boundaries, additional acreage was acquired by the North Carolina Wetland Restoration Program and an expanded Compensatory Wetland Mitigation Design Plan was prepared for the Site in October 2001. Upon completion of the detailed plan the project was bid on May 17, 2002. Backwater Environmental, a subsidiary of Osborne Co. Inc., was awarded the construction contract and work initiated on June 18, 2002. Earthwork associated with the project was completed within 4 weeks and the Site was planted in the winter of 2002.

Completed project activities, reporting history, and completion dates are summarized in Table 2.

Table 2. Project Activity and Reporting History

Project Name/Number: Howell Woods (EEP Project Number 183)

Activity or Report	Scheduled Completion	Data Collection Completion	Actual Completion or Delivery
Initial Feasibility Report	---	---	Apr 1999
Mitigation Alternatives Analysis	Spring 2000	---	Spring 2000
Initial Site Planting (approximately 19 acres)	Mar 2000	---	Mar 2000
Year 1 Monitoring (2001)	Fall 2002	---	Nov 2002
Additional Property Acquisition	---	---	*
Compensatory Wetland Mitigation Design Plan	Oct 2001	---	Oct 2001
Site Implementation (Wetland/Backwater Slough)	Fall 2002	---	Jul 2002
Site Planting (approximately 12 acres)	Dec 2002	---	Dec 2002
Year 2 Monitoring (2003)	Dec 2003	---	Dec 2003
Year 3 Monitoring (2004)	Dec 2004	---	Dec 2004
Year 4 Monitoring (2005)	Dec 2005	---	Dec 2005
Year 5 Monitoring (2006)	Dec 2006	Nov 2006	Nov 2006
Year 6 Monitoring (2007) (Groundwater Gauges Only)	Dec 2007	Nov 2007	Nov 2007
Year 7 Monitoring (2008) (Groundwater Gauges Only)	Dec 2008	Nov 2008	Dec 2008

Contact information regarding project designer, construction, planting contractor, and monitoring personnel are summarized in Table 3 and relevant project background information is summarized in Table 4.

Table 3. Project Contact Table

Project Name/Number: Howell Woods (EEP Project Number 183)

Designer	EcoScience Corporation 1101 Haynes Street, Suite 101 Raleigh, North Carolina 27604 Jerry McCrain (919) 828-3433
Construction Contractor	Backwater Environmental PO Box 1654 Pittsboro, North Carolina 27312 Wes Newell (919) 523-4375
Planting Contractor	Carolina Silvics 908 Indian Trail Road Edenton, North Carolina 27932 Dwight McKinney
Monitoring Performers Years 5-7 (2006-2008)	Axiom Environmental, Inc. 2126 Rowland Pond Dr. Willow Spring, NC 27592
Monitoring Point of Contact	Grant Lewis 919-215-1693

Table 4. Project Background Table

Project Name/Number: Howell Woods (EEP Project Number 183)

Project County	Johnston County, North Carolina
Drainage Area	Primary Neuse River - 1870 square miles Secondary Gar Gut - 9.8 square miles
Drainage impervious cover estimate (%)	< 5
Stream Order	second
Physiographic Region	Coastal Plain
Ecoregion	Southeastern Floodplains and Low Terraces
Rosgen Classification of As-built	D-type
Cowardin Classification	PF01
Dominant Soil Types	Altavista, State, Wehadkee, and Chastain
Reference Site ID	Onsite
USGS HUC for Project and Reference	Project and Reference – 03020201
NCDWQ Subbasin for Project and Reference	Project and Reference – 03-04-04
Any portion of any project segment 303d listed?	No (Stream Index #27-52-7)
Any portion of any project segment upstream of a 303d listed segment?	Yes, reach of the Neuse River in Subbasin 03-04-05 – Stream Index # 27-(56b)
Reasons for 303d listing or stressor	Mercury Level in Fish
% of project easement fenced	0

1.4 Monitoring Plan View

Monitoring activities for the Site, including relevant structures and utilities, project features, specific project structures, and monitoring features are detailed in Figure 3.

Site features have been monitored through the use of continuous recording groundwater gauges, permanently monumented vegetation plots, an onsite rain gauge, and photographic documentation. The Site contains 14 groundwater gauges including two reference gauges and 12 mitigation area gauges. Several gauges malfunctioned over the past few years and were replaced. The current groundwater monitoring scheme is depicted in Figure 3. Gauge manufacturer and types include Remote Data Systems (RDS) WL 40, RDS Ecotone, and Infinities.

There are five vegetation plots on the Site that have been permanently monumented with five-foot metal fence posts, driven into each of the four corners of the plot, with PVC pipe attached for ease in plot location identification.

2.0 PROJECT CONDITION AND MONITORING RESULTS

2.1 Vegetation Assessment

In the fall of 2001, vegetation monitoring plots were randomly established within the Site. Each sample plot was composed of two-300-foot transects extending from a central point, usually a groundwater monitoring gauge. The Site was monitored for the as-built and the 2002 (year 1) growing season utilizing this methodology with vegetation success achieved.

During the 2003 (year 2) monitoring period, North Carolina State University implemented a revised vegetation monitoring procedure based on the *Draft Vegetation Monitoring Plan for NCWRP Riparian Buffer and Wetland Restoration Projects* document (undated). Five-10 meter by 10 meter plots were established and permanently marked with pipe. The location of each vegetation monitoring plot is depicted on Figure 3.

2.1.1 Soil Data

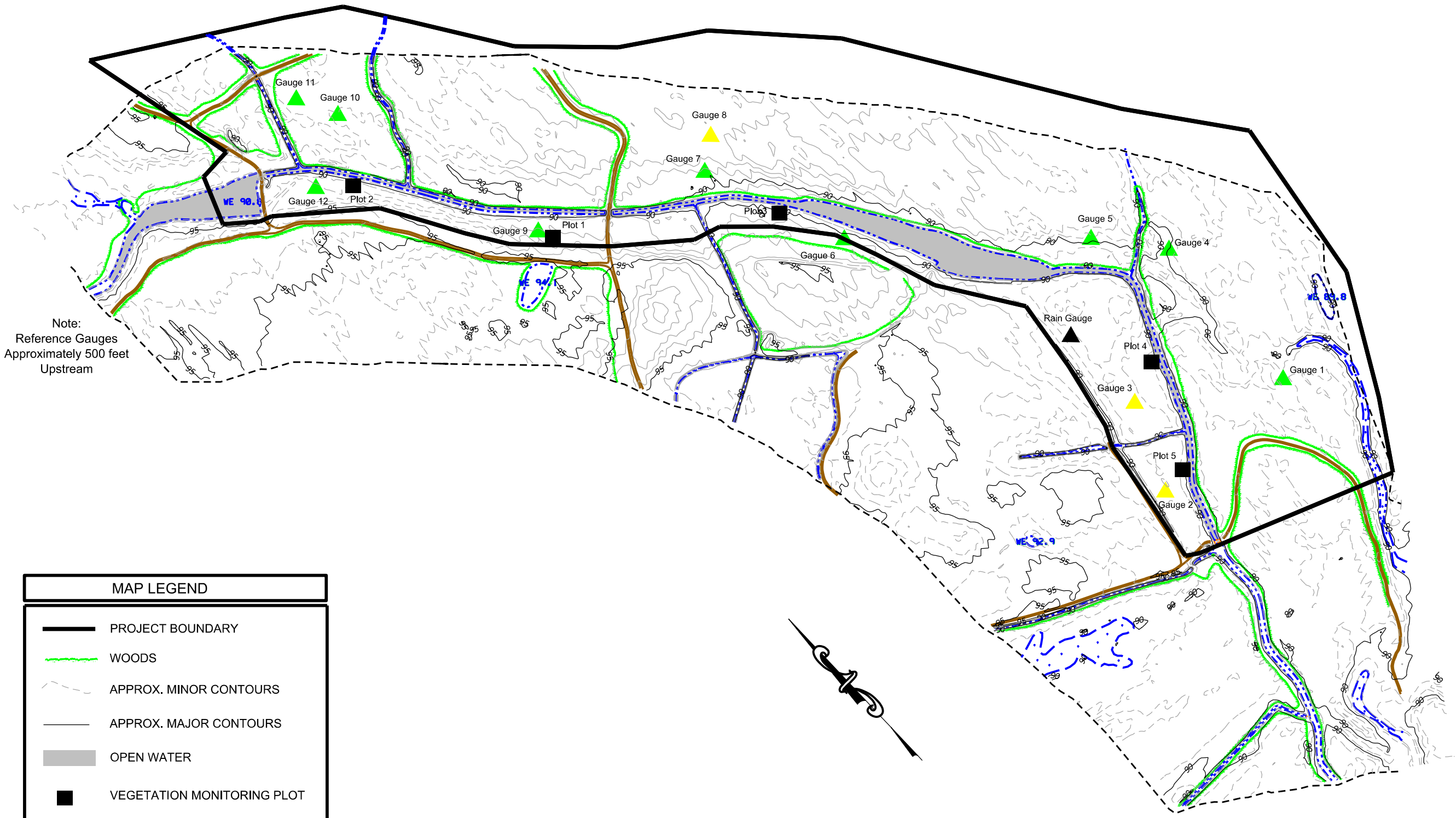
General soil conditions found onsite, including level of erosion and percentage of organic matter, are summarized in Table 5.

Table 5. Preliminary Soil Data

Project Name/Number: Howell Woods (EEP Project Number 183)

Series	Max Depth (inches)	% Clay on Surface	K	T	OM %
Altavista	+60	10 - 20	0.24	5	0.5 - 3
State	+60	5 - 15	0.28	5	<2
Wehadkee	+60	5 - 20	0.24	5	2 – 5
Chastain	+72	27 - 50	0.28	5	1 - 6

Agricultural activities and excavation associated with Site implementation resulted in the exposure of subsurface soil horizons; therefore, a reduction in percent clay and organic matter in the soil surface layers occurred. In addition, erosion factors are calculated based on the percentage of silt, sand, and organic matter and are likely to have been affected by Site development and implementation as well. Values of erosion factors K and T have likely been elevated above the amount published in the Johnston County Soil Survey (USDA 1994).



MAP LEGEND

- PROJECT BOUNDARY
- WOODS
- APPROX. MINOR CONTOURS
- APPROX. MAJOR CONTOURS
- OPEN WATER
- VEGETATION MONITORING PLOT
- MONITORING GAUGE (>12.5 %)
- MONITORING GAUGE (5 - 12.5 %)
- MONITORING GAUGE (<5 %)

MAP COMPILED BY PHOTOGRAMMETRIC METHODS.

Axiom Environmental, Inc.

REVISIONS

Client:

WETLANDS
RESTORATION
PROGRAM

Raleigh, North Carolina

Project:

HOWELL WOODS
RESTORATION SITE

Project Number 183
Year 7 (2008 Monitoring Report)

JOHNSTON COUNTY,
NORTH CAROLINA

Title:

MONITORING
PLAN

Dwn By:	Date:
WGL	Sept 2008
Ckd By:	Scale:
WGL	1"= 500'

AXE Project No.:
08-001

FIGURE
3

2.1.2 Vegetative Problem Areas

No vegetation problem areas were identified within the Site during year 7 (2008) monitoring. All previously noted vegetation problem areas have resolved naturally.

2.1.3 Stem Counts

Five vegetation plots had been previously established by North Carolina State University as depicted in Figure 3. The plots are 10 meters square and are located randomly within the Site. These plots were surveyed for five monitoring seasons; results for years 2 through 5 (2003 through 2006) are included in Table 7. No reference area was studied; therefore no comparisons could be made to reference conditions.

Table 6. Stem Counts for Planted Species Arranged by Plot

Project Name/Number: Howell Woods (EEP Project Number 183)

Species	Year 5 (2006) Individual Plot Data (0.0247 acre each)					Year 2 (2003) Totals	Year 3 (2004) Totals	Year 4 (2005) Totals	Year 5 (2006) Totals	% Survival
	1	2	3	4	5					
Cephalanthus occidentalis	0	0	0	0	0	6	0	0	0	0
Crataegus sp.	0	3	0	5	0	*	0	0	8	*
Diospyros virginiana	0	1	0	1	0	*	0	0	2	*
Fraxinus pennsylvanica	0	14	0	5	0	22	21	28	19	86
Ilex deciduas	0	0	0	1	0	*	0	0	1	*
Platanus occidentalis	1	0	0	2	2	4	3	3	5	125
Populus heterophylla	0	1	0	0	0	*	0	0	1	*
Quercus lyrata	0	0	0	1	0	0	0	0	1	--
Quercus nigra	0	0	0	0	0	1	1	1	0	0
Quercus pagoda	1	0	1	0	0	4	5	4	2	50
Quercus phellos	1	5	2	0	0	7	7	6	8	114
Quercus sp.	0	2	0	0	0	0	0	0	2	--
Taxodium distichum	0	0	1	0	1	1	1	1	2	200
Ulmus americana	0	0	0	0	1	*	0	0	1	*
Ulmus rubra	1	0	2	1	0	*	0	0	4	*
Ulmus sp.	0	1	36	16	27	*	185	130	80	*
Total Stems Per Plot	**4**	**27**	**42**	**32**	**31**	**45***	**223**	**173**	**136**	*
Stems Per Acre	**162**	**1093**	**1700**	**1296**	**1255**	**364**	**1806**	**1401**	**1101**	

* - Historical project documents necessary to provide this data were unavailable at the time of this report submission.

Due to the revised monitoring protocol during the second year of vegetation surveys, no comparisons of as-built or 2002 (year 1) can be made to the subsequent monitoring years. Therefore, planted species have been based upon previous annual monitoring reports and percent survival is based on a comparison of 2003 (year 2) totals where possible. The phased planting schedule made it difficult to determine planted trees from naturally recruited trees; therefore, the number of "planted" species was based on the experience and judgment of the monitoring team, and counts for planted species may be influenced by naturally recruited stems. During preparation of this monitoring report, no as-built mitigation plan or data for 2002 (year 1) totals were available and therefore, are not included in the table.

Results from vegetation surveys exceeded success criteria with 346, 1806, 1401, and 1101 planted stems per acre present in years 2 through 5, respectively with an increase in species diversity over the 5-year monitoring period. No data was available for year 1 monitoring. Based on these results, Site vegetation should be considered successful.

2.1.4 Vegetation Plot Photos

Photographs were taken at all permanent photo points and are included in Appendix A. The photographs show that vegetation is generally growing well and consists of a good combination of woody and herbaceous species.

2.2 Wetland Assessment

Fourteen groundwater monitoring gauges have been maintained and monitored throughout the year 7 (2008) growing season (Appendix B). Twelve are located within the restoration areas and two are located within the reference wetlands immediately northwest of the Site. The groundwater gauges record daily readings of groundwater depth. Daily rainfall data recorded from a rain gauge maintained and monitored on the Site was used for seasonal comparison. Groundwater gauge graphs for years 1 (2002) through year 6 (2007) are included in Appendices D-I, respectively. Table 7 summarizes success criteria for groundwater gauges over the 7-year monitoring period.

Success criteria based on the 2002 Monitoring Plan for wetland hydrology require that the area be inundated or saturated within 12 inches of the ground surface for a consecutive period of 12.5 percent of the growing season. The growing season in Johnston County begins March 21 and ends November 4 (229 days). Areas inundated less than 5 percent of the growing season (11 days) are classified as nonwetlands. Areas inundated between 5 percent and 12.5 percent of the growing season can be classified as wetlands depending upon factors such as the presence of hydrophytic vegetation and hydric soils. In order to attain hydrologic success, saturation within 12 inches of the ground surface is required for at least 11 consecutive days (5 percent of the growing season) or 29 consecutive days (12.5 percent of the growing season).

All groundwater gauges had a presence of hydrophytic wetland vegetation and hydric soils based on criteria set forth in the *Corps of Engineers Wetland Delineation Manual*. Vegetation lists for each gauge can be found in Appendix C.

Groundwater hydrology within 12 inches of the soil surface occurred for greater than 12.5 percent of the growing season for the year 7 (2008) growing season at Gauges 1, 4-7, and 9-12 and greater than 5 percent of the growing season at Gauges 2, 3, and 8.

2.2.1 Wetland Problem Area Plan View

No wetland problem areas have been identified during the year 7 (2008) monitoring period. As depicted in Appendix B, all gauges are currently functioning and recorded groundwater hydrology within 12 inches of the ground surface for at least 5 percent of the growing season with a presence of hydrophytic vegetation.

Table 7. Summary of Groundwater Gauge Results for Years 1 through 7

Project Name/Number: Howell Woods (EEP Project Number 183)

Gauge	Historic Description	Serial Number	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)						
			Year 1 (2002)^	Year 2 (2003)*	Year 3 (2004)**	Year 4 (2005)	Year 5 (2006)	Year 6 (2007)	Year 7 (2008)
1	RDSA	S2C9894	Yes/>12.5%	No Data	No Data	No Data	Yes/34 days (14.8 %)	Yes/43 days (18.8 %)	Yes/64 days (27.9%)
2	RDSB	B6522D1	Yes/>12.5%	No Data	No Data	Malfunctioned ***	Yes/25 days (11.0 %)	No/10 days (4.4 %)	Yes/11 days (5 %)
3	RDSC	B6B6E09	No/<5%	No Data	No Data	Malfunctioned ***	No/8 days (3.9 %)	No/8 days (3.9 %)	Yes/11 days (5 %)
4	INF6	A279A59	Malfunctioned	No Data	No Data	No Data	Yes/76 days (33.2%)	Yes/66 days (28.8%)	Yes/80 days (34.9%)
5	INF5	A28984F	Malfunctioned/ <5%	No Data	No Data	No Data	Yes/229 days (100 %)	Yes/80 days (34.9 %)	Yes/96 days (41.9%)
6	RDSD	B6B4FB9	Malfunctioned/ <5%	No Data	No Data	Malfunctioned ***	Yes/33 days (14.4 %)	Yes/47 days (20.5 %)	Yes/35 days (15.3%)
7	INF1/ JG6	EBD85C9	Yes/5-12.5%	Yes/73 days (31.9%)	No Data	Yes/36 days (15.7 %)	Yes/168 days (73.4 %)	Yes/68 days (29.7 %)	Yes/82 days (35.8%)
8	INF2	A3C095A	Malfunctioned	Mal- functioned	No Data	No Data	Yes/19 days (8.3 %)	Yes/15 days (6.6 %)	Yes/18 days (7.9%)
9	RDSE	B652374	No/<5%	No Data	No Data	Malfunctioned/ 4 days (1.7 %) ***	Yes/29 days (12.7 %)	Yes/44 days (19.2 %)	Yes/37 days (16.2%)
10	INF4	A286A2D	Malfunctioned/ <5%	Yes/54 days (23.6%)	No Data	No Data	Yes/68 days (29.7 %)	Yes/43 days (18.8 %)	Yes/63 days (27.5%)
11	INF3	AB36608	Malfunctioned/ <5%	Yes/54 days (23.6%)	No Data	No Data	Yes/32 days (14.0 %)	Yes/41 days (17.9 %)	Yes/51 days (22.3%)

Gauge	Historic Description	Serial Number	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)						
			Year 1 (2002)^	Year 2 (2003)*	Year 3 (2004)**	Year 4 (2005)	Year 5 (2006)	Year 6 (2007)	Year 7 (2008)
12	RDSF	B652408	No/ <5%	No Data	No Data	Malfunctioned/ 4 days (1.7 %) ***	Yes/52 days (22.7 %)	Yes/ 43 days (18.8 %)	Yes/51 days (22.2%)
Ref1	REF1	N386A9F1	Yes/>12.5%	Yes/70 days (30.6%)	No Data	No Data	Yes/34 days (14.8 %)	Yes/56 days (24.4 %)	Yes/64 days (27.9%)
Ref2	REF2	N3B6AA64	Yes/>12.5%	Yes/74 days (32.3%)	No Data	No Data	Yes/72 days (31.4 %)	Yes/55 days (24.0 %)	Yes/63 days (27.5%)

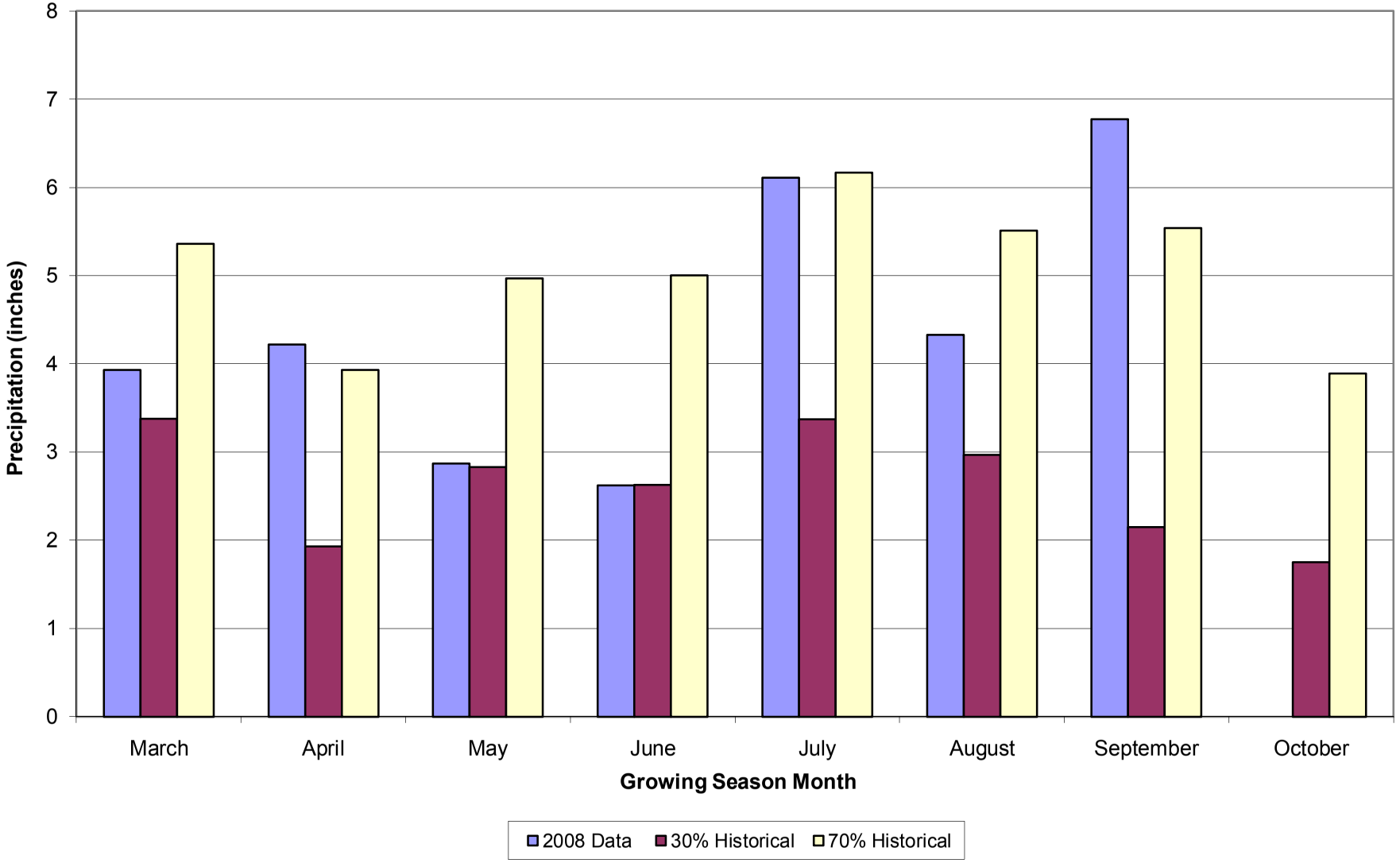
^ - Gauges malfunctioned for the majority of the growing season. Site construction did not occur until mid-growing season; therefore, gauges will be monitored for a sixth growing season.

* - Data for most of the end of the growing season was unavailable.

** - Graph is included in the year 3 (2004) report for one of the Infinities gauges; however, it does not indicate which one.

*** - Gauges malfunctioned for the first several months of the growing season.

Figure 4. 2008 Climatic Data vs. 30-year Historic Data



2.2.2 Wetland Criteria Attainment

All monitored gauges within restoration areas met success criteria of inundation/saturation within 12 inches of the surface for at least 5 percent of the growing season with a presence of hydrophytic vegetation (Table 8). Hydrographs containing precipitation and groundwater data for each gauge can be found in Appendix B. Photographs for vegetation plots can be found in Appendix A.

Table 8. Wetland Criteria Attainment

Project Name/Number: Howell Woods (EEP Project Number 183)

Gauge ID	Hydrology Threshold Met?	Hydrophytic Vegetation Criteria Met?	Site Mean	Vegetation Plot ID	Vegetation Survival Threshold Met?	Site Mean
1	Yes	Yes	100 %	1	Yes	100 %
2	Yes	Yes		2	Yes	
3	Yes	Yes		3	Yes	
4	Yes	Yes		4	Yes	
5	Yes	Yes		5	Yes	
6	Yes	Yes				
7	Yes	Yes				
8	Yes	Yes				
9	Yes	Yes				
10	Yes	Yes				
11	Yes	Yes				
12	Yes	Yes				

3.0 SEVEN-YEAR MONITORING ASSESSMENT

In summary, the Site achieved success criteria for vegetation and hydrology for over the seven-year monitoring period.

Results from vegetation surveys exceeded success criteria with 346, 1806, 1401, and 1101 planted stems per acre present in years 2 through 5, respectively; with an increase in species diversity over the monitoring period.

Previous vegetative problem areas within the Site have resolved naturally and no vegetation or wetland problem areas were present within the Site during year 7 (2008) monitoring.

Groundwater hydrology within 12 inches of the soil surface occurred for greater than 12.5 percent of the growing season for the year 7 (2008) growing season at Gauges 1, 4-7, and 9-12 and for at least 5 percent of the growing season at Gauges 2, 3, and 8. Vegetation documented in the vicinity of each of the twelve restoration area groundwater gauges was considered hydrophytic wetland vegetation. In addition, wetland criteria set forth in the *Corps of Engineers Wetland Delineation Manual* were met with the presence of the three criteria, 1) hydric soils, 2) hydrophytic vegetation, and 3) wetland hydrology at all gauges.

In summary, the Site achieved success criteria for hydrology and vegetation in the Seventh Monitoring Year (2007). Based on available data, the Site achieved success criteria for hydrology and vegetation over the entire 7-year monitoring period.

4.0. REFERENCES

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

North Carolina Wetlands Restoration Program (NCWRP). Undated. Draft Internal Guidance for Vegetation Monitoring Plans for NCWRP Riparian Buffer and Wetland Restoration Projects. North Carolina Department of Environment and Natural Resources, Raleigh, North Carolina.

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

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

United States Army Corps of Engineers (USACE) and North Carolina Department of Environment and Natural Resources. 2005. Information Regarding Stream Restoration in the Outer Coastal Plain of North Carolina. Available: http://h2o.enr.state.nc.us/ncwetlands/documents/CoastalPlainSTreamMitigationFinalDraftPolicyNov28.doc [October 30, 2006].

United States. Department of Agriculture (USDA). 1994. Soil Survey of Johnston County, North Carolina. United States Department of Agriculture.

APPENDIX A

VEGETATION PHOTOGRAPHS

Appendix A

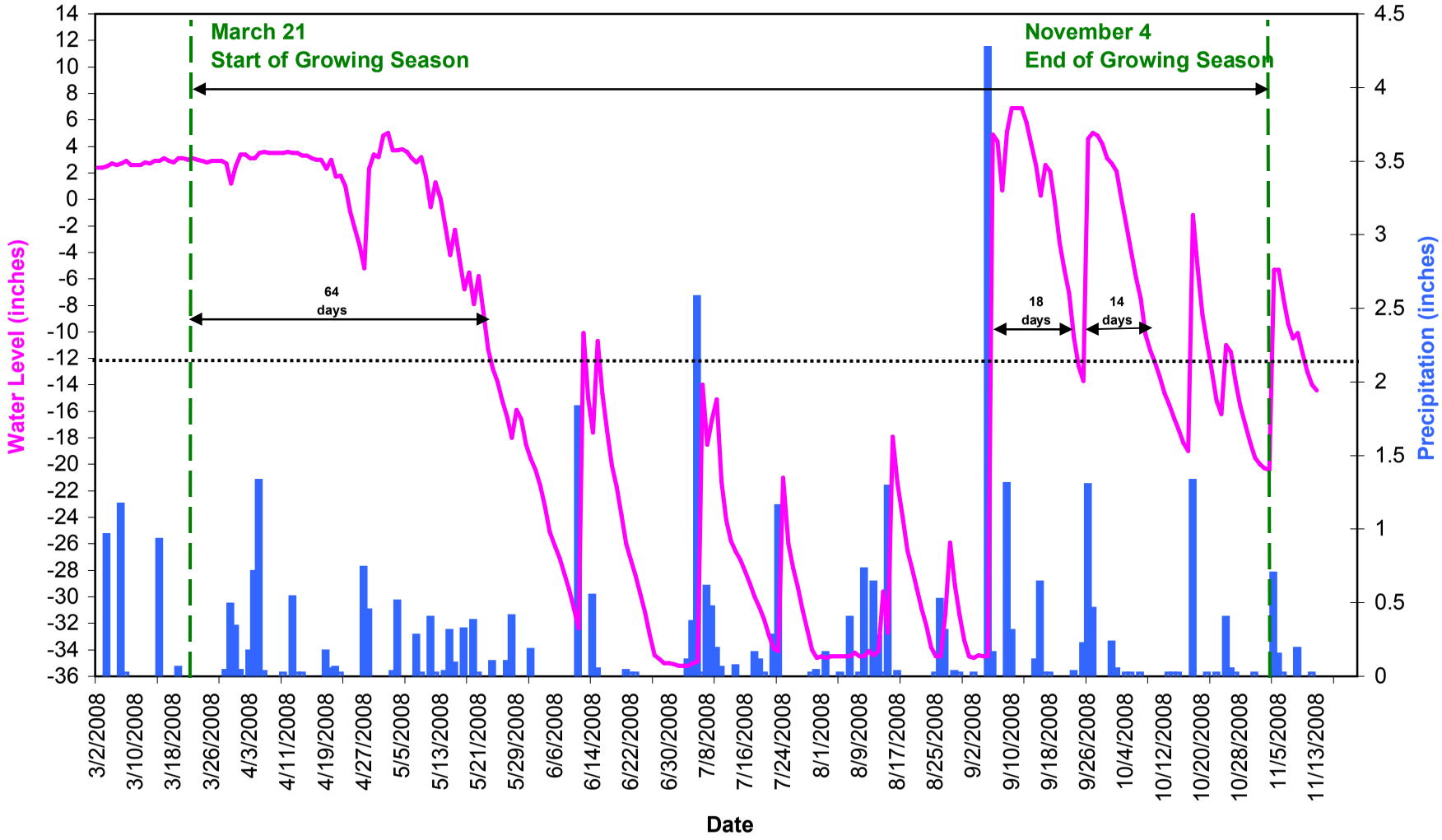
Vegetation Plot Photographs

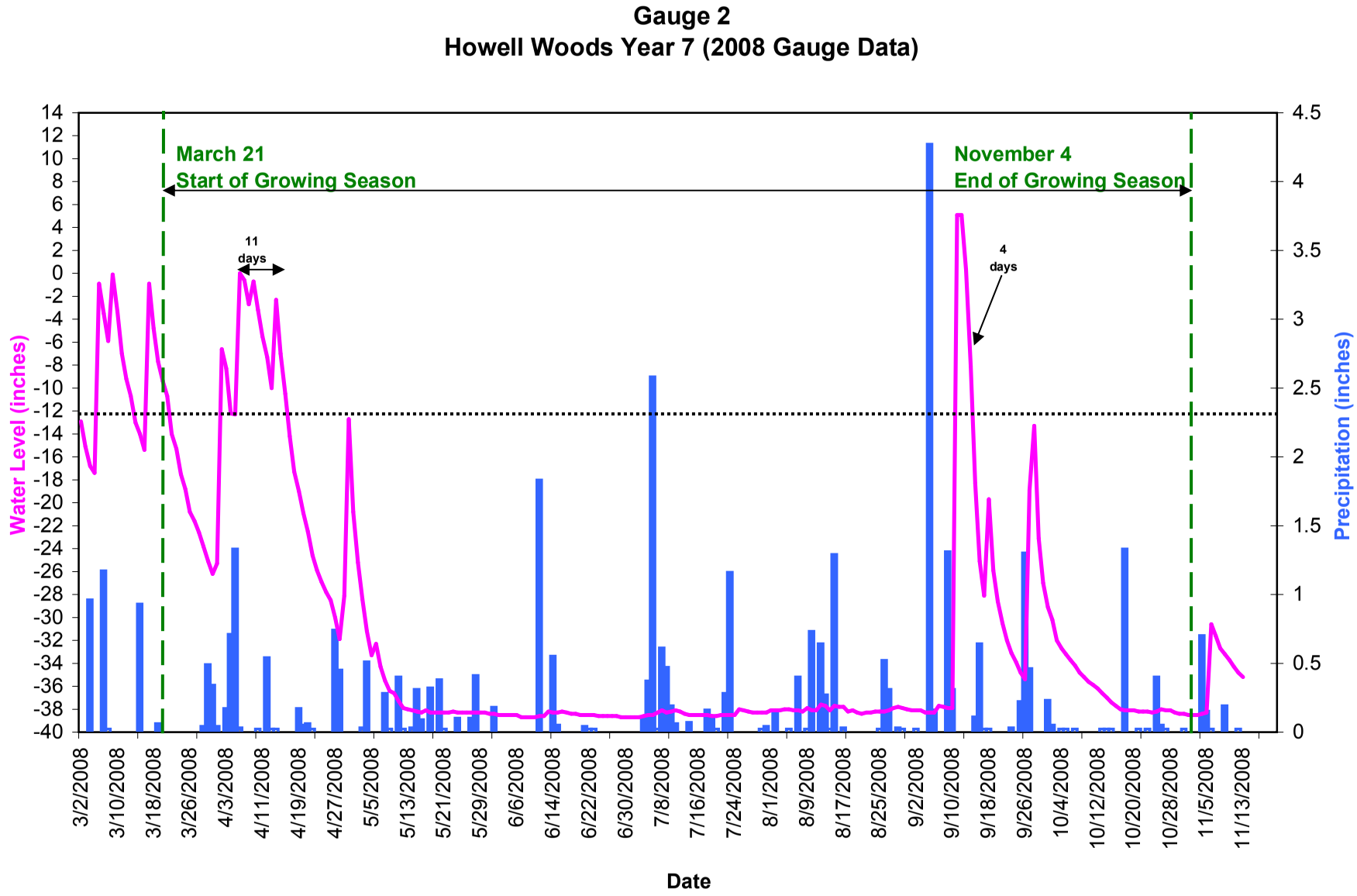
Taken September 2, 2008

APPENDIX B

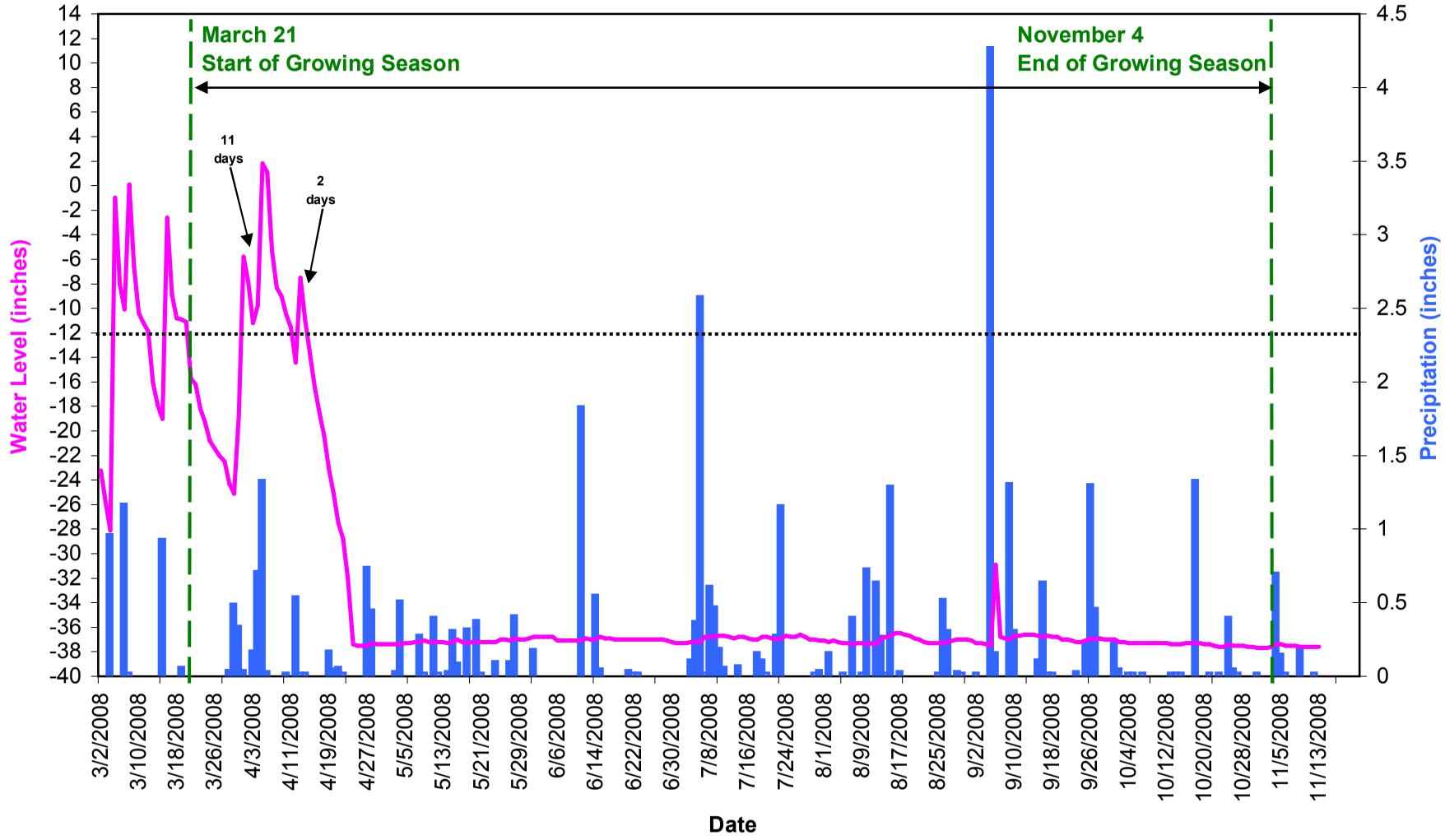
YEAR 7 (2008) GROUNDWATER GAUGE GRAPHS

Gauge 1
Howell Woods Year 7 (2008 Gauge Data)

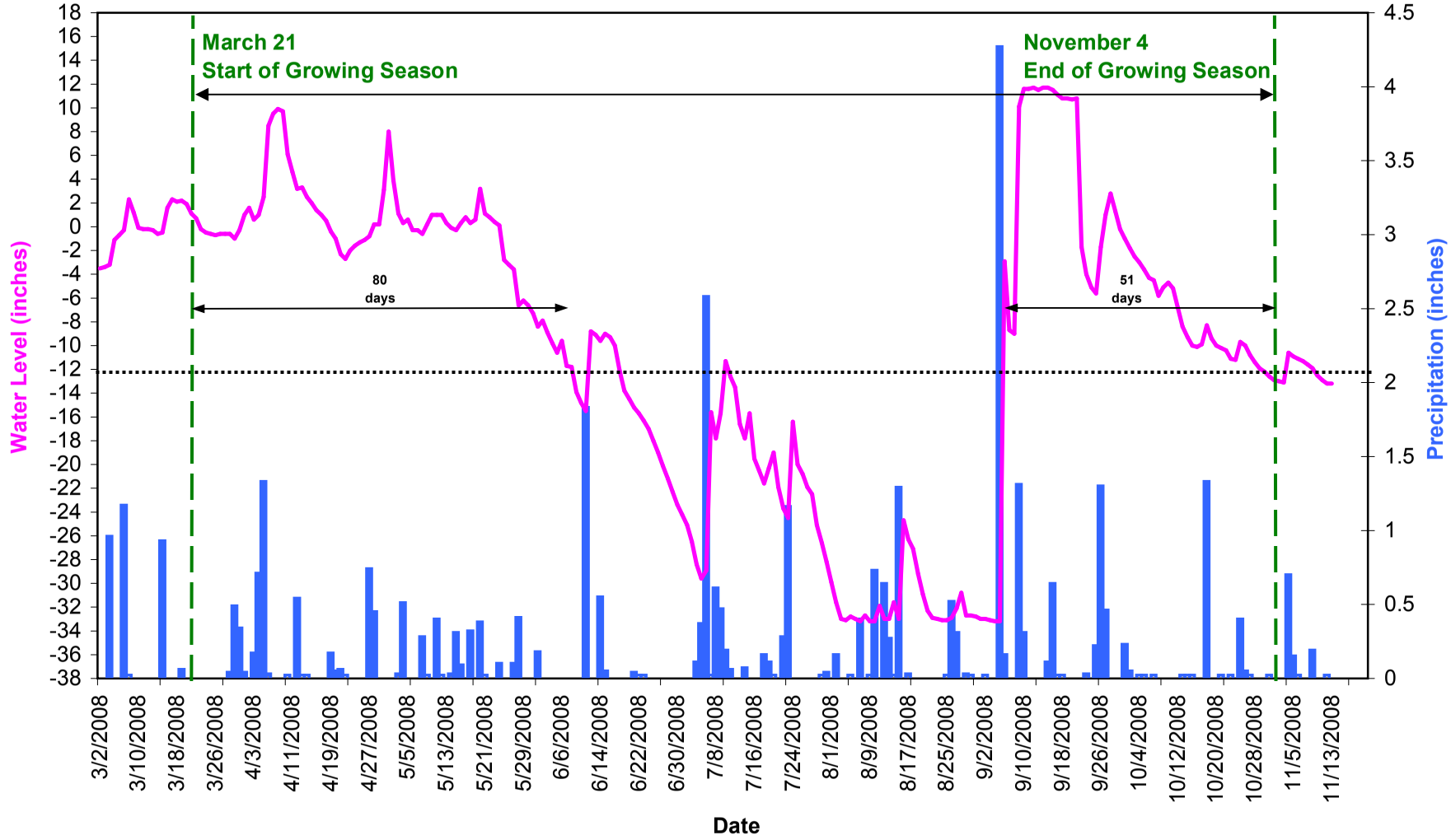



Gauge 2
Howell Woods Year 7 (2008 Gauge Data)
March 21
Start of Growing Season
November 4
End of Growing Season
11
days
4
days
Water Level (inches)
Precipitation (inches)
Date
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
3/2/2008
3/10/2008
3/18/2008
3/26/2008
4/3/2008
4/11/2008
4/19/2008
4/27/2008
5/5/2008
5/13/2008
5/21/2008
5/29/2008
6/6/2008
6/14/2008
6/22/2008
6/30/2008
7/8/2008
7/16/2008
7/24/2008
8/1/2008
8/9/2008
8/17/2008
8/25/2008
9/2/2008
9/10/2008
9/18/2008
9/26/2008
10/4/2008
10/12/2008
10/20/2008
10/28/2008
11/5/2008
11/13/2008

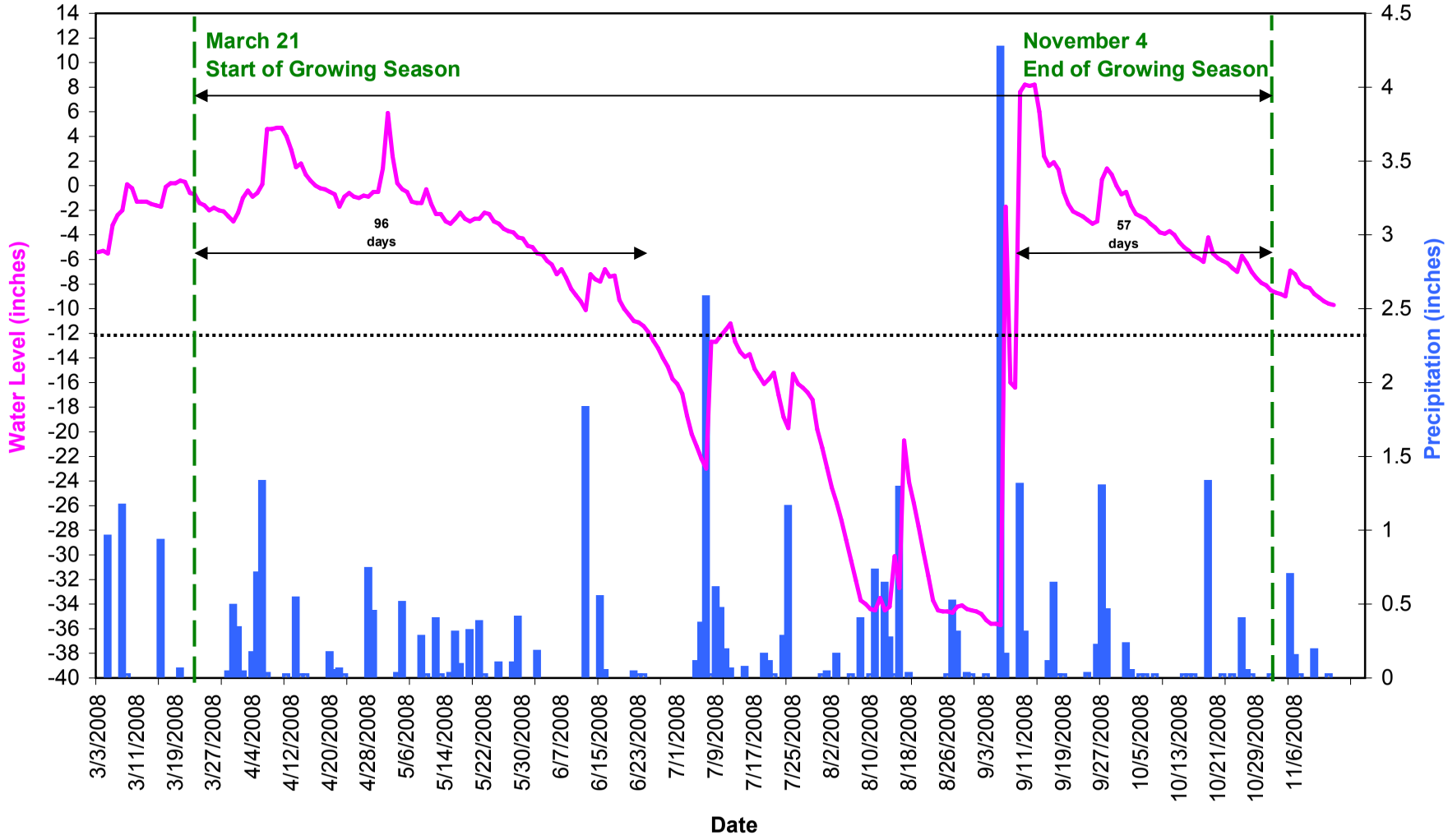
Gauge 3
Howell Woods Year 7 (2008 Gauge Data)



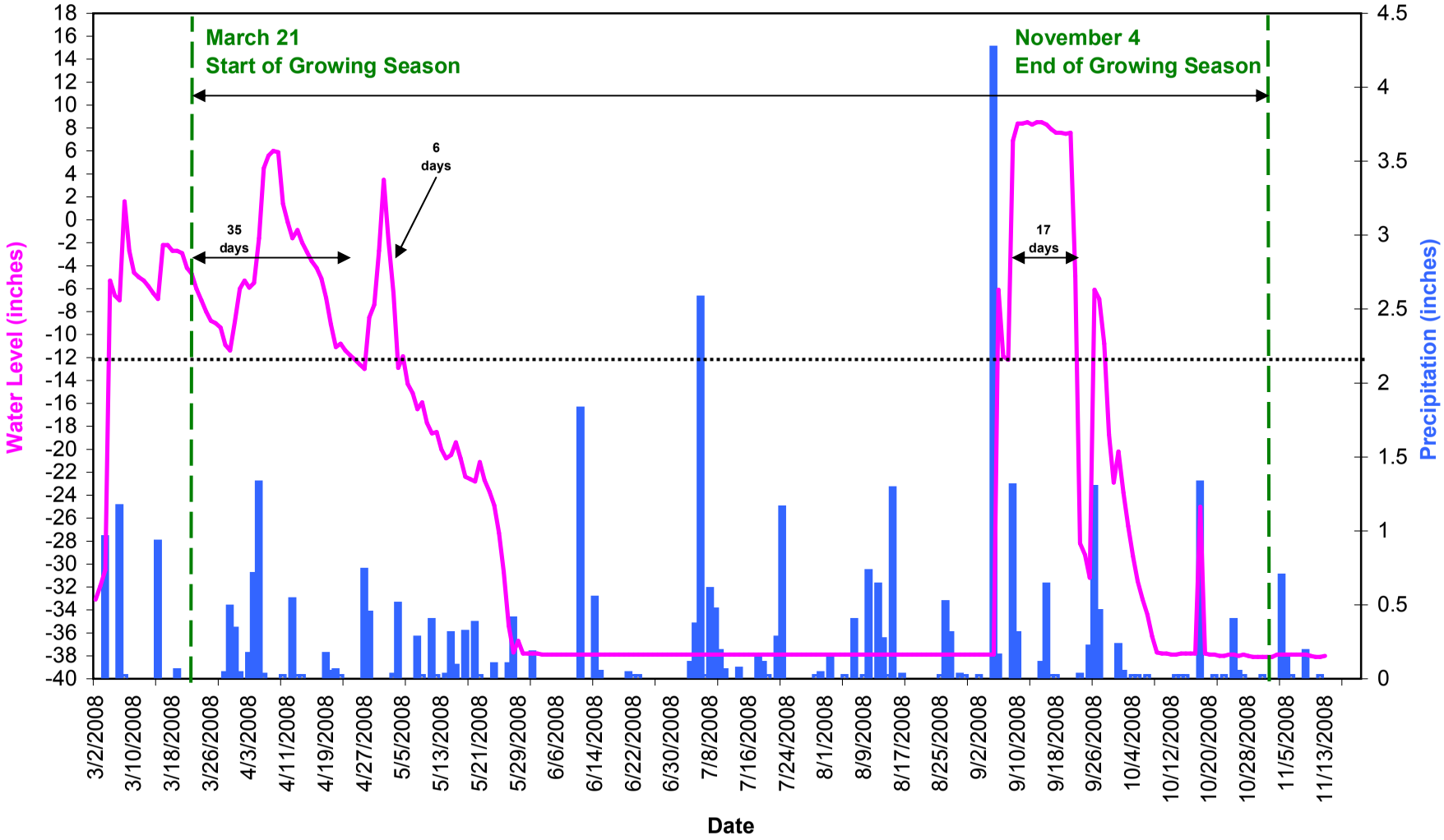
Gauge 4
Howell Woods Year 7 (2008 Gauge Data)



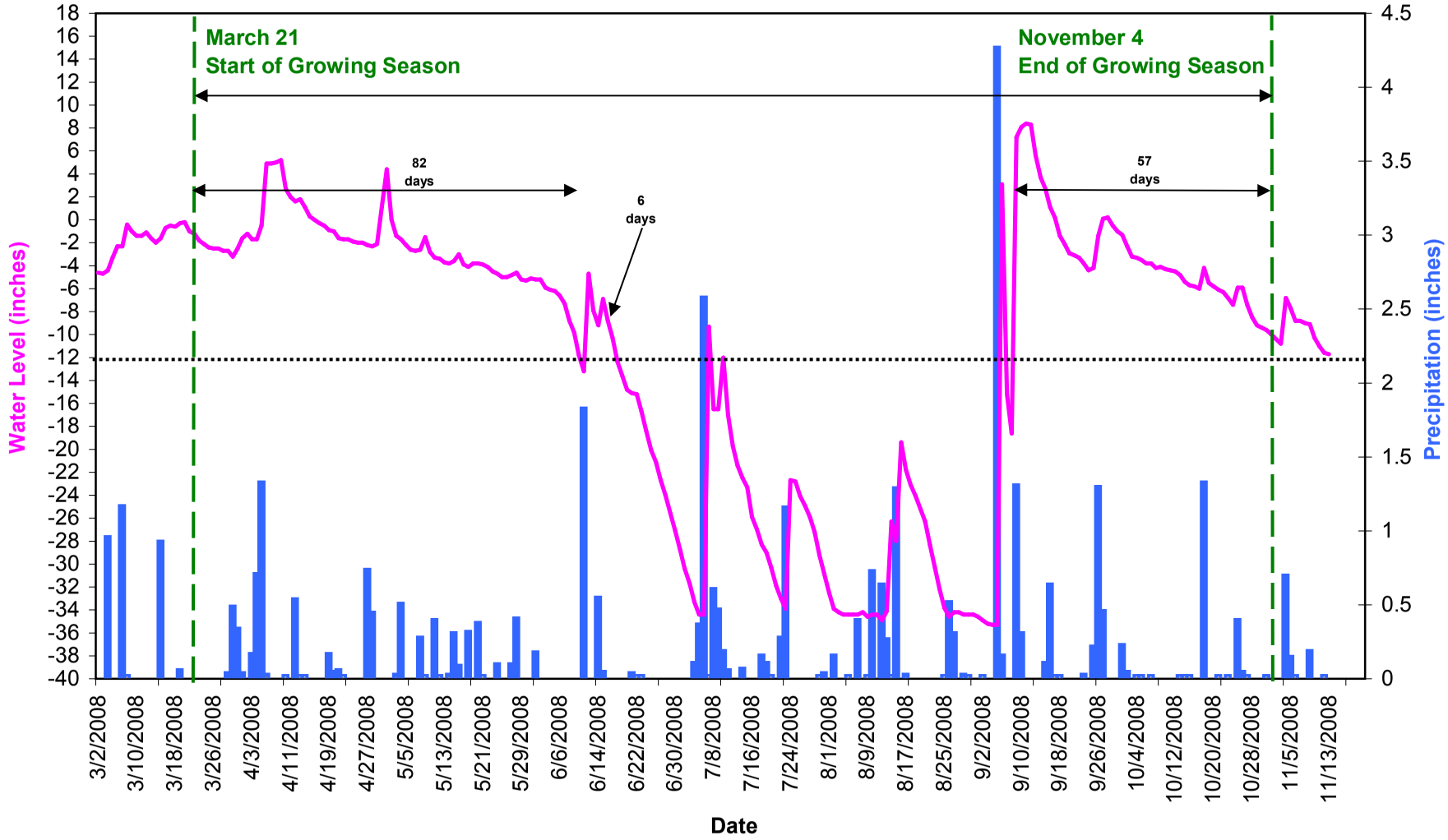
Gauge 5
Howell Woods Year 7 (2008 Gauge Data)



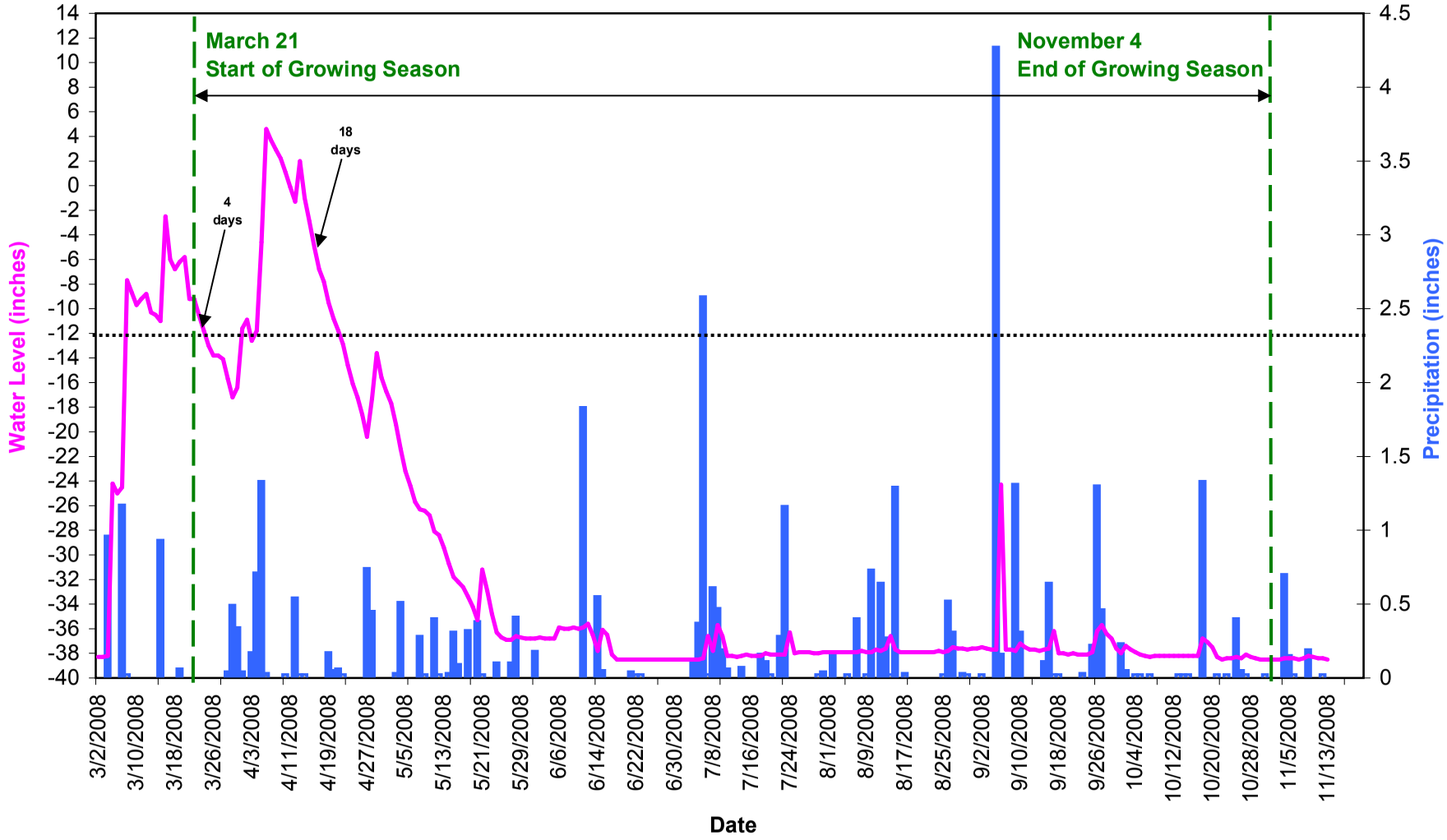
Gauge 6
Howell Woods Year 7 (2008 Gauge Data)



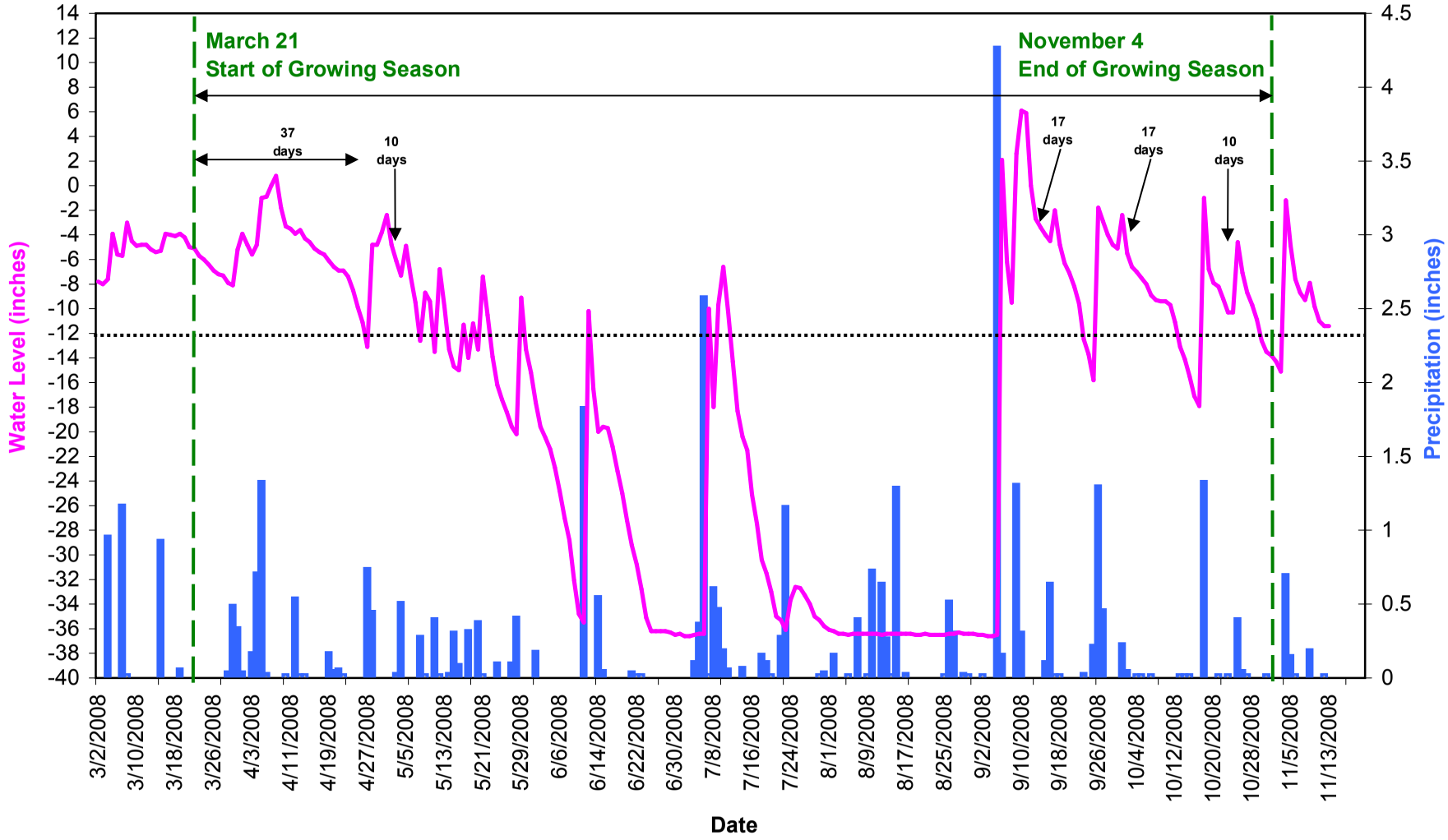
Gauge 7
Howell Woods Year 7 (2008 Gauge Data)



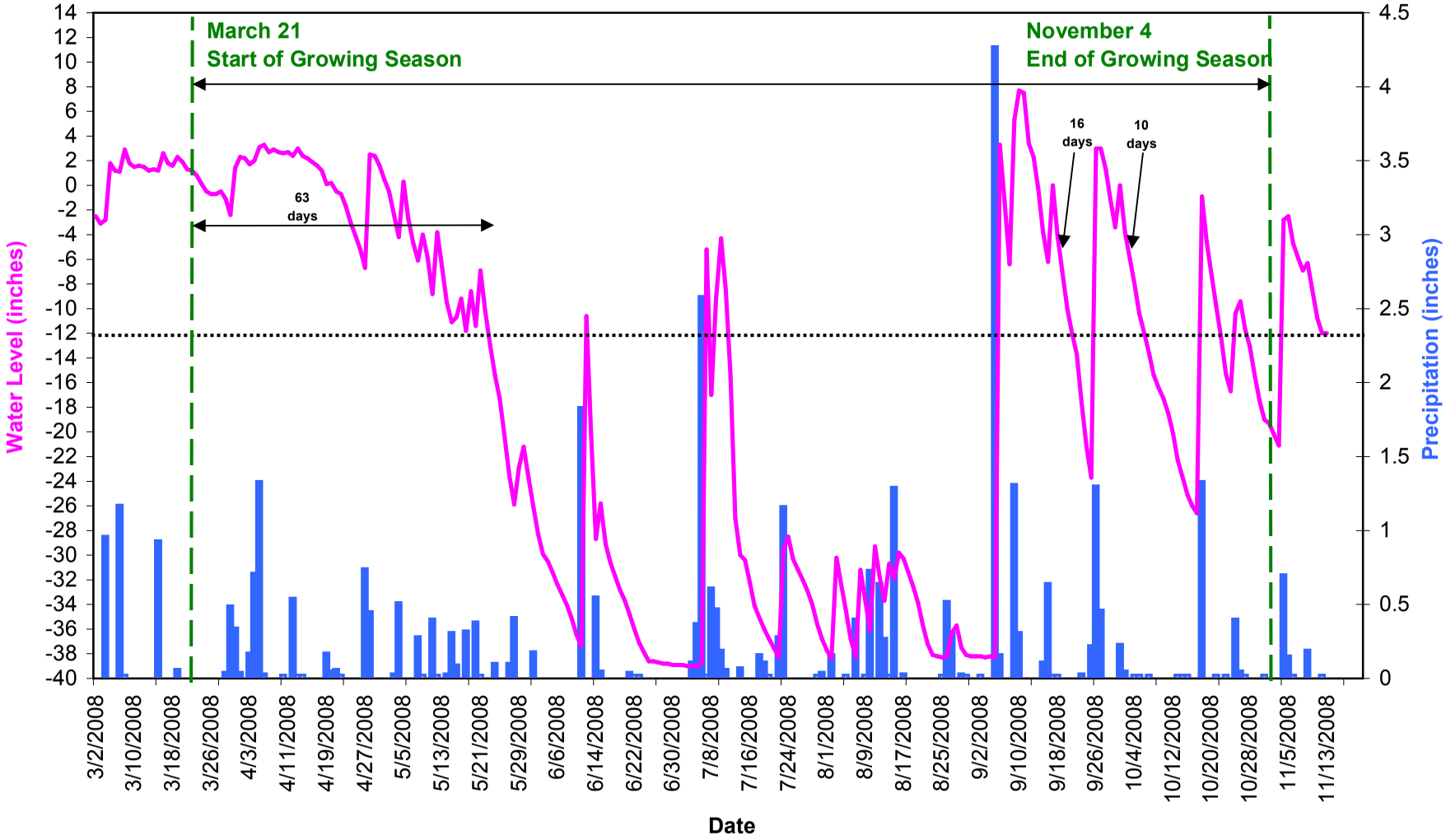
Gauge 8
Howell Woods Year 7 (2008 Gauge Data)



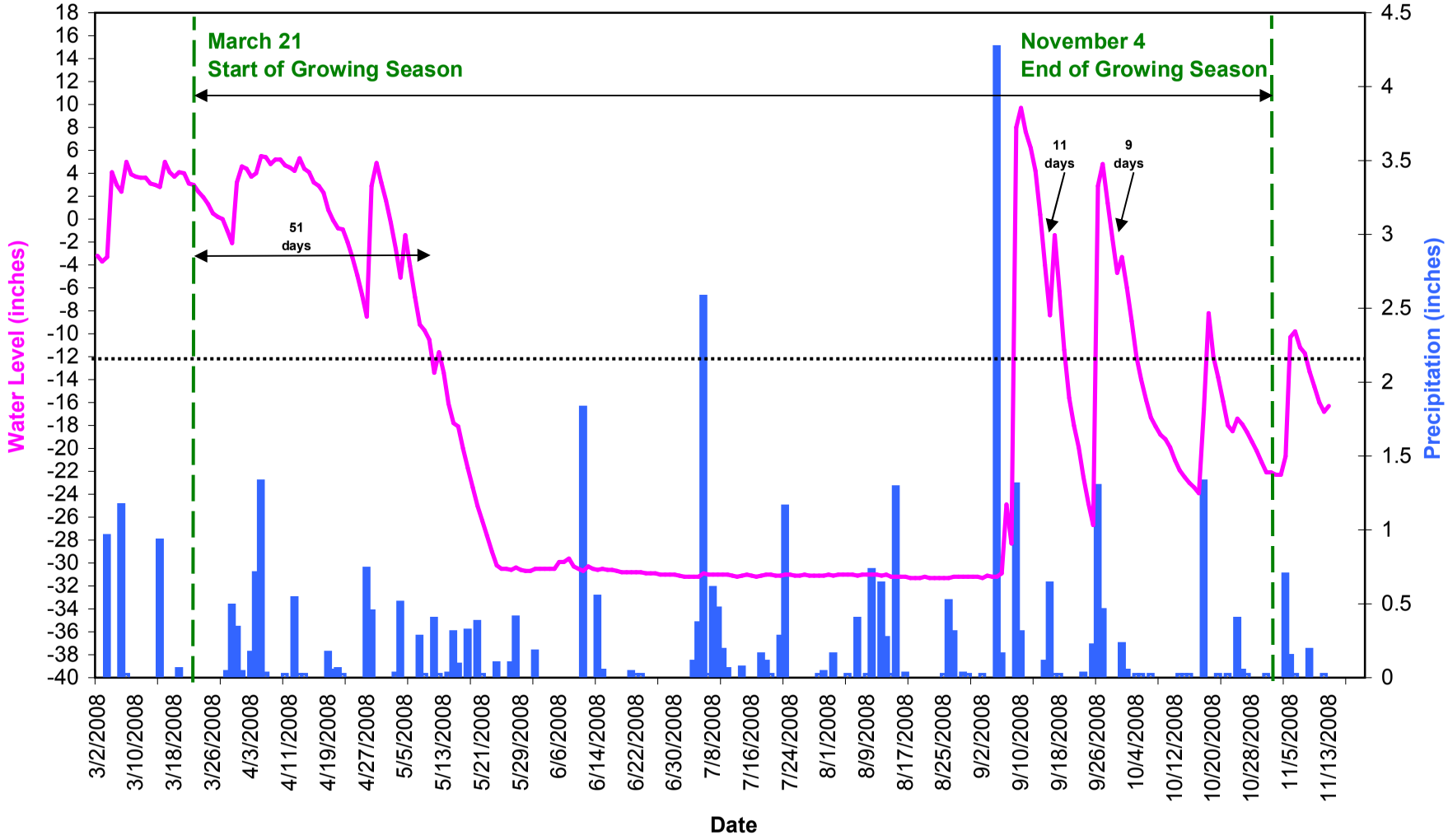
Gauge 9
Howell Woods Year 7 (2008 Gauge Data)



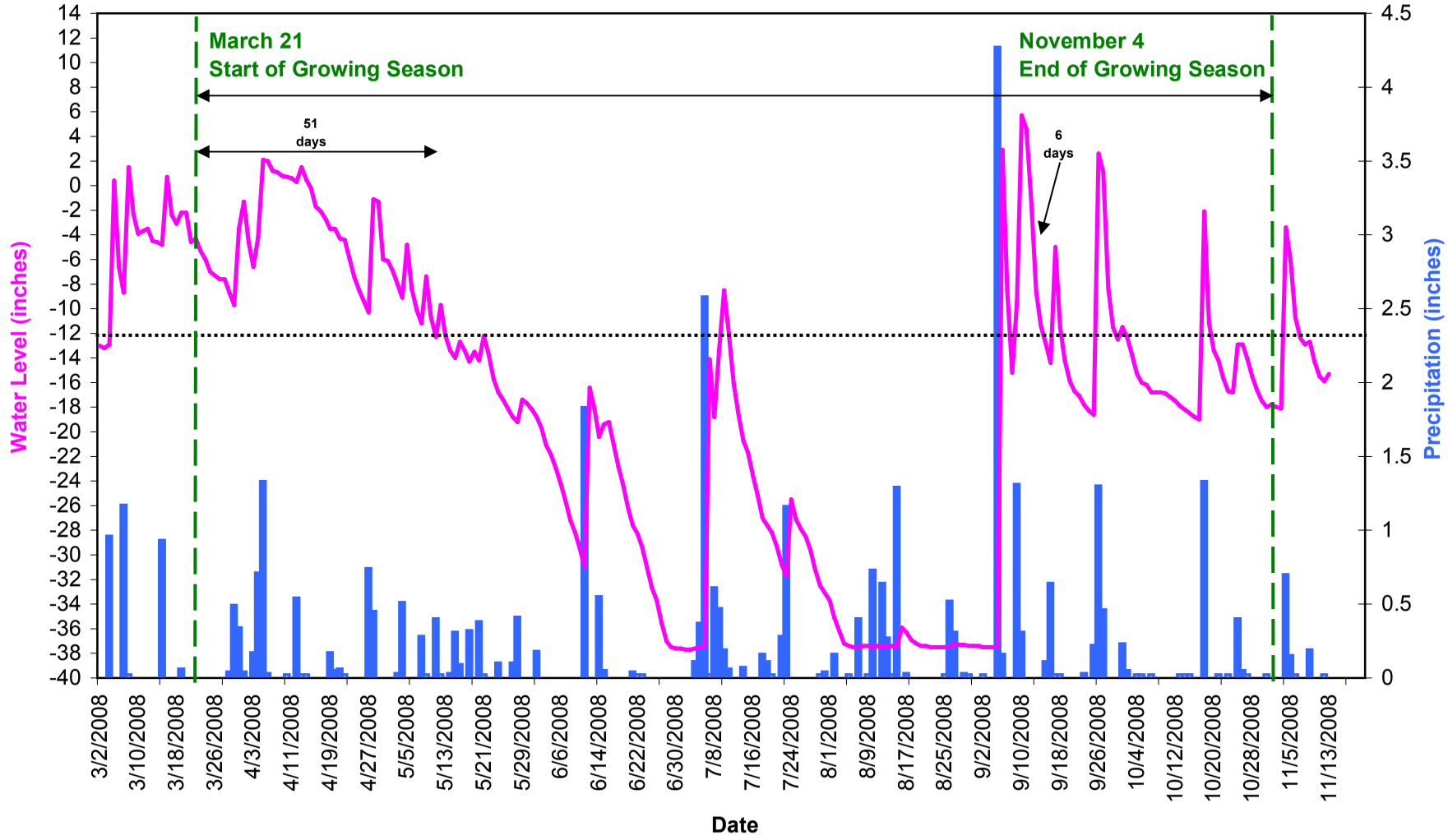
Gauge 10
Howell Woods Year 7 (2008 Gauge Data)



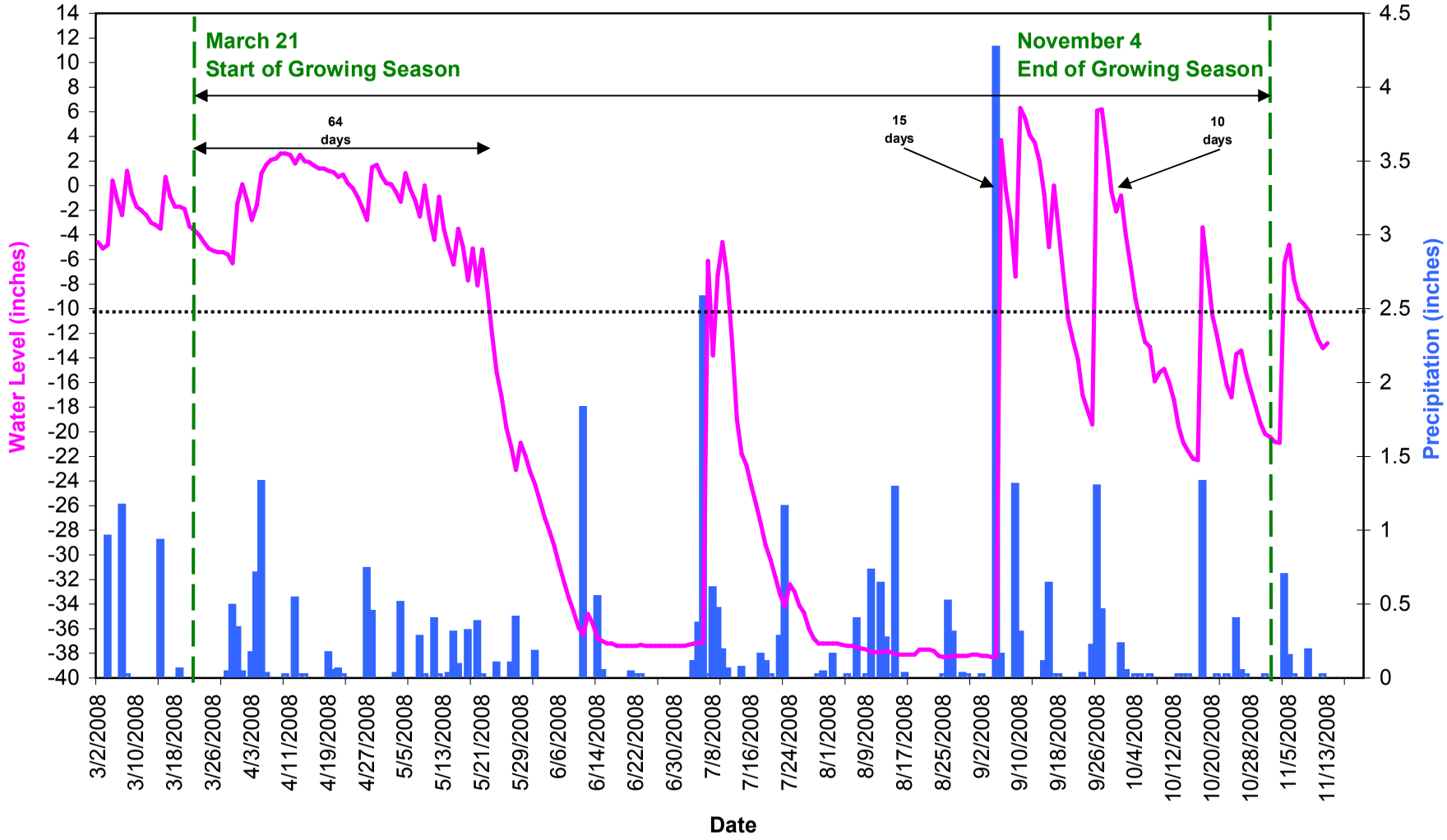
Gauge 11
Howell Woods Year 7 (2008 Gauge Data)



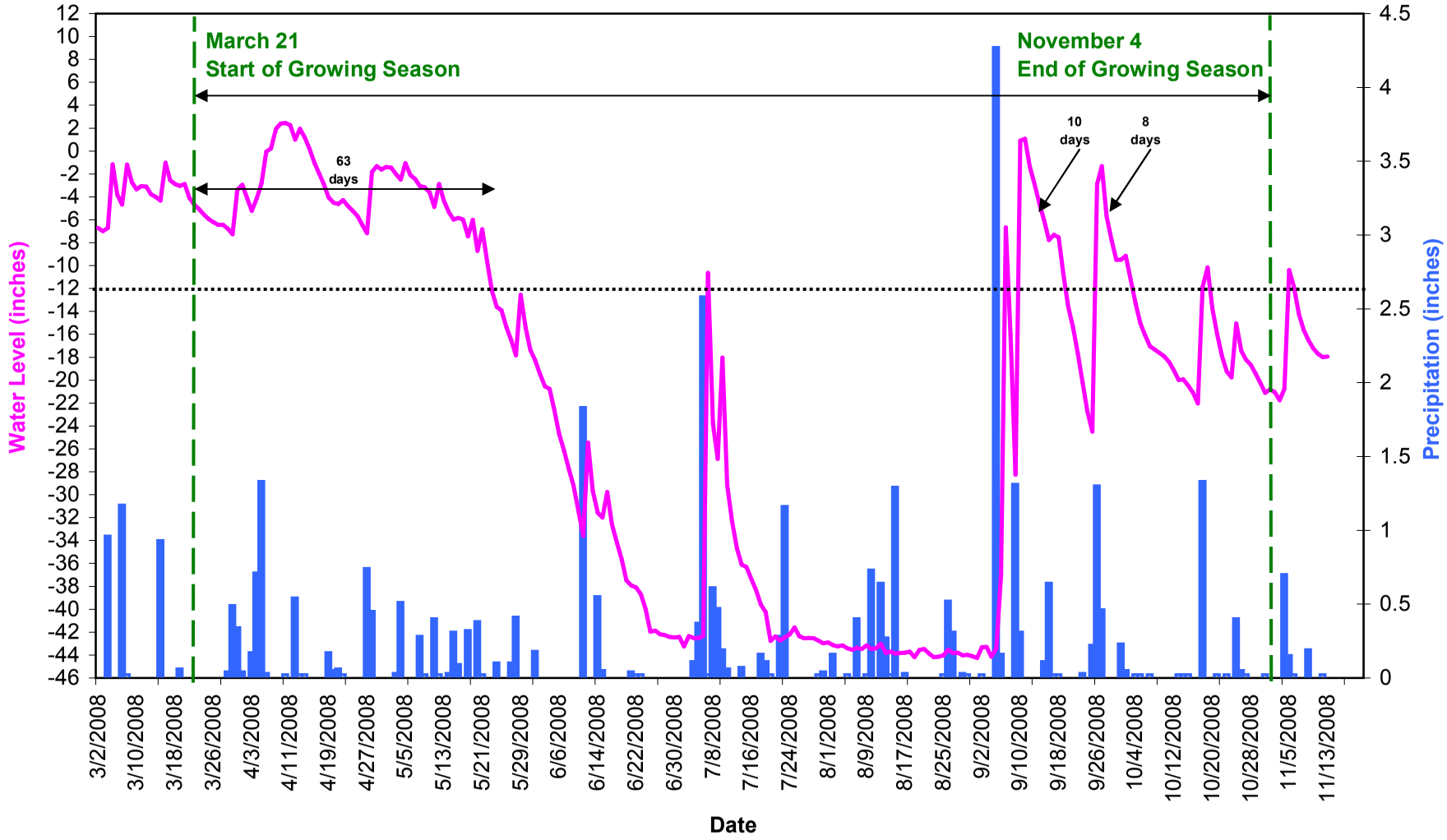
Gauge 12
Howell Woods Year 7 (2008 Gauge Data)



Reference Gauge 1
Howell Woods Year 7 (2008 Gauge Data)



Reference Gauge 2
Howell Woods Year 7 (2008 Gauge Data)



APPENDIX C

YEAR 7 (2008) GAUGE VEGETATION LISTS

YEAR 7 (2008) GAUGE VEGETATION LISTS
HOWELL WOODS RESTORATION SITE
July 14, 2008

GAUGE 1

	Dominant Plant Species	Stratum	Indicator
1.	*Quercus phellos*	Canopy	FACW-
2.	*Fraxinus pennsylvanica*	Canopy	FACW
3.	*Liquidambar styraciflua*	Canopy	FAC+
4.	*Ulmus americana*	Canopy	FACW
5.	*Celtis laevigata*	Canopy	FACW
6.	*Ulmus rubra*	Sapling	FAC
7.	*Carpinus caroliniana*	Sapling	FAC
8.	*Quercus lyrata*	Sapling	OBL
9.	*Ilex decidua*	Shrub	FACW-
10.	*Carya cordiformis*	Shrub	FAC
11.	*Carex* spp.	Herb	FAC to OBL
12.	*Commelina virginica*	Herb	FACW
13.	*Leersia lenticularis*	Herb	OBL
14.	*Arundinaria gigantean*	Herb	FACW
15.	*Saururus cernuus*	Herb	OBL
16.	*Smilax rotundifolia*	Vine	FAC

Percent of Dominant Species that are OBL, FACW, or FAC (except FAC-) = **100%**

GAUGE 2

	Dominant Plant Species	Stratum	Indicator
1.	*Ulmus alata*	Canopy	FACU+
2.	*Fraxinus pennsylvanica*	Canopy	FACW
3.	*Liquidambar styraciflua*	Canopy	FAC+
4.	*Ulmus* sp.	Canopy	FAC to FACW
5.	*Platanus occidentalis*	Canopy	FACW-
6.	*Quercus pagoda*	Canopy	FAC+
7.	*Quercus phellos*	Canopy	FACW-
8.	*Crataegus* sp.	Canopy	FAC to OBL
9.	*Quercus lyrata*	Sapling	OBL
10.	*Dulchium arundinaceum*	Herb	OBL
11.	*Juncus effusus*	Herb	FACW+
12.	*Carex lurida/comosa*	Herb	OBL

Percent of Dominant Species that are OBL, FACW, or FAC (except FAC-) = **92%**

GAUGE 3

	Dominant Plant Species	Stratum	Indicator
1.	*Ulmus alata*	Canopy	FACU+
2.	*Fraxinus pennsylvanica*	Canopy	FACW
3.	*Liquidambar styraciflua*	Canopy	FAC+
4.	*Acer rubrum*	Canopy	FAC
5.	*Celtis laevigata*	Canopy	FACW
6.	*Carex* spp.	Herb	FAC to OBL
7.	*Parthenocissus quinquefolia*	Herb	FAC
8.	*Toxicodendron radicans*	Herb	FAC
9.	*Boehmeria cylindrica*	Herb	FACW+

Percent of Dominant Species that are OBL, FACW, or FAC (except FAC-) = **89%**

YEAR 7 (2008) HOWELL WOODS (continued)
July 14, 2008

GAUGE 4

	Dominant Plant Species	Stratum	Indicator
1.	*Nyssa biflora*	Canopy	OBL
2.	*Ulmus americana*	Canopy	FACW
3.	*Acer rubrum*	Canopy	FAC
4.	*Quercus lyrata*	Canopy	OBL
5.	*Ilex decidua*	Shrub	FAC-
6.	*Carex* spp.	Herb	FAC to OBL
7.	*Leersia lenticularis*	Herb	OBL
8.	*Boehmeria cylindrica*	Herb	FACW+
9.	*Saururus cernuus*	Herb	OBL
10.	*Commelina virginica*	Herb	FACW
11.	*Smilax bona-nox*	Herb	FAC
12.	*Microstegium vimineum*	Herb	FAC+

Percent of Dominant Species that are OBL, FACW, or FAC (except FAC-) = **92%**

GAUGE 5

	Dominant Plant Species	Stratum	Indicator
1.	*Ulmus americana*	Canopy	FACW
2.	*Nyssa biflora*	Canopy	OBL
3.	*Liquidambar styraciflua*	Canopy	FAC+
4.	*Celtis laevigata*	Sapling	FACW
5.	*Crataegus* sp.	Sapling	FAC to OBL
6.	*Carpinus caroliniana*	Sapling	FAC
7.	*Fraxinus pennsylvanica*	Shrub	FACW
8.	*Ilex decidua*	Shrub	FACW-
9.	*Boehmeria cylindrica*	Herb	FACW+
10.	*Carex* spp.	Herb	FAC to OBL
11.	*Smilax rotundifolia*	Herb	FAC
12.	*Acer rubrum*	Herb	FAC
13.	*Commelina virginica*	Herb	FACW
14.	*Arundinaria gigantean*	Herb	FACW
15.	*Leersia lenticularis*	Herb	OBL

Percent of Dominant Species that are OBL, FACW, or FAC (except FAC-) = **100%**

GAUGE 6

	Dominant Plant Species	Stratum	Indicator
1.	*Ulmus alata*	Canopy	FACU+
2.	*Ulmus rubra*	Canopy	FAC
3.	*Liquidambar styraciflua*	Canopy	FAC+
4.	*Acer rubrum*	Canopy	FAC
5.	*Fraxinus pennsylvanica*	Canopy	FACW
6.	*Betula nigra*	Canopy	FACW
7.	*Crataegus* sp.	Sapling	FAC to OBL
8.	*Carex* spp.	Herb	FAC to OBL
9.	*Campsis radicans*	Herb	FAC
10.	*Saururus cernuus*	Herb	OBL
11.	*Boehmeria cylindrica*	Herb	FACW+
12.	*Commelina virginica*	Herb	FACW

Percent of Dominant Species that are OBL, FACW, or FAC (except FAC-) = **92%**

YEAR 7 (2008) HOWELL WOODS (continued)
July 14, 2008

GAUGE 7

	Dominant Plant Species	Stratum	Indicator
1.	*Nyssa biflora*	Canopy	OBL
2.	*Celtis laevigata*	Canopy	FACW
3.	*Acer rubrum*	Canopy	FAC
4.	*Fraxinus pennsylvanica*	Canopy	FACW
5.	*Liquidambar styraciflua*	Canopy	FAC+
6.	*Ulmus rubra*	Sapling	FAC
7.	*Acer rubrum*	Sapling	FAC
8.	*Crataegus* sp.	Sapling	FAC to OBL
9.	*Ilex deciduas*	Shrub	FACW-
10.	*Carpinus caroliniana*	Shrub	FAC
11.	*Carex* spp.	Herb	FAC to OBL
12.	*Smilax rotundifolia*	Herb	FAC
13.	*Microstegium vimeneum*	Herb	FAC+
14.	*Commelina virginica*	Herb	FACW
15.	*Boehmeria cylindrica*	Herb	FACW+

Percent of Dominant Species that are OBL, FACW, or FAC (except FAC-) = **100%**

GAUGE 8

	Dominant Plant Species	Stratum	Indicator
1.	*Quercus phellos*	Canopy	FACW-
2.	*Liquidambar styraciflua*	Canopy	FAC+
3.	*Ulmus americana*	Canopy	FACW
4.	*Acer rubrum*	Canopy	FAC
5.	*Diospyros virginiana*	Sapling	FAC
6.	*Carpinus caroliniana*	Sapling	FAC
7.	*Ilex decidua*	Sapling	FACW-
8.	*Fraxinus pennsylvanica*	Shrub	FACW
9.	*Vitis rotundifolia*	Herb	FAC
10.	*Carex* spp.	Herb	FAC to OBL
11.	*Commelina virginica*	Herb	FACW
12.	*Boehmeria cylindrical*	Herb	FACW+
13.	*Smilax rotundifolia*	Herb	FAC

Percent of Dominant Species that are OBL, FACW, or FAC (except FAC-) = **100%**

GAUGE 9

	Dominant Plant Species	Stratum	Indicator
1.	*Liquidambar styraciflua*	Canopy	FAC+
2.	*Diospyros virginiana*	Canopy	FAC
3.	*Populus deltoids*	Canopy	FAC+
4.	*Acer rubrum*	Shrub	FAC
5.	*Salix nigra*	Shrub	OBL
6.	*Taxodium distichum*	Shrub	OBL
7.	*Crataegus* sp.	Shrub	FAC to OBL
8.	*Cornus amomum*	Shrub	FACW+
9.	*Hibiscus moscheutos*	Herb	OBL
10.	*Aster vimineus*	Herb	FAC
11.	*Andropogon virginicus*	Herb	FACU
12.	*Carex* spp.	Herb	FAC to OBL
13.	*Juncus effusus*	Herb	FACW+
14.	*Scirpus cyperinus*	Herb	OBL
15.	*Seteria geniculata*	Herb	FAC
16.	*Rubus argutus*	Herb	FACU+

Percent of Dominant Species that are OBL, FACW, or FAC (except FAC-) = **94%**

YEAR 7 (2008) HOWELL WOODS (continued)
July 14, 2008

GAUGE 10

	Dominant Plant Species	Stratum	Indicator
1.	*Carpinus caroliniana*	Canopy	FAC
2.	*Fraxinus pennsylvanica*	Canopy	FACW
3.	*Liquidambar styraciflua*	Canopy	FAC+
4.	*Acer rubrum*	Canopy	FAC
5.	*Diospyros virginiana*	Canopy	FAC
6.	*Nyssa biflora*	Canopy	OBL
7.	*Ilex decidua*	Sapling	FACW-
8.	*Carex* spp.	Herb	FAC to OBL
9.	*Microstegium vimineum*	Herb	FAC
10.	*Leersia lenticularis*	Herb	OBL
11.	*Smilax rotundifolia*	Herb	FAC

Percent of Dominant Species that are OBL, FACW, or FAC (except FAC-) = **100%**

GAUGE 11

	Dominant Plant Species	Stratum	Indicator
1.	*Nyssa biflora*	Canopy	OBL
2.	*Acer rubrum*	Canopy	FAC
3.	*Liquidambar styraciflua*	Canopy	FAC+
4.	*Fraxinus pennsylvanica*	Canopy	FAC+
5.	*Ulmus* sp.	Canopy	FAC to FACW
6.	*Carpinus caroliniana*	Sapling	FAC
7.	*Ilex decidua*	Sapling	FACW-
8.	*Diospyros virginiana*	Shrub	FAC
9.	*Smilax rotundifolia*	Shrub	FAC
10.	*Carex spp.*	Herb	FAC to OBL
11.	*Commelina virginica*	Herb	FACW
12.	*Bignonia capreolata*	Herb	FAC
13.	*Leersia lenticularis*	Herb	OBL
14.	*Toxicodendron radicans*	Herb	FAC
15.	*Saururus cernuus*	Herb	OBL

Percent of Dominant Species that are OBL, FACW, or FAC (except FAC-) = **100%**

GAUGE 12

	Dominant Plant Species	Stratum	Indicator
1.	*Quercus lyrata*	Canopy	OBL
2.	*Quercus pagoda*	Canopy	FAC
3.	*Quercus phellos*	Canopy	FACW-
4.	*Crataegus* sp.	Sapling	FAC to OBL
5.	*Populus deltoids*	Sapling	FAC+
6.	*Fraxinus pennsylvanica*	Sapling	FACW
7.	*Platanus occidentalis*	Sapling	FACW-
8.	*Betula nigra*	Sapling	FACW
9.	*Taxodium distichum*	Sapling	OBL
10.	*Ulmus* sp.	Sapling	FAC to FACW
11.	*Liquidambar styraciflual*	Shrub	FAC+
12.	*Hibiscus moscheutos*	Herb	OBL
13.	*Aster vimineus*	Herb	FAC
14.	*Acer rubrum*	Herb	FAC
15.	*Carex* sp.	Herb	FAC to OBL
16.	*Acalypha rhomboidea*	Herb	FAC-
17.	*Panicum agrostoides*	Herb	FACW
18.	*Diospyros virginiana*	Herb	FAC
19.	*Ptilimnium capillaceum*	Herb	OBL

Percent of Dominant Species that are OBL, FACW, or FAC (except FAC-) = **95%**

YEAR 7 (2008) HOWELL WOODS (continued)
July 14, 2008

REFERENCE GAUGE 1

	Dominant Plant Species	Stratum	Indicator
1.	*Quercus lyrata*	Canopy	OBL
2.	*Nyssa biflora*	Canopy	OBL
3.	*Ulmus americana*	Canopy	FACW
4.	*Acer rubrum*	Canopy	FAC
5.	*Fraxinus pennsylvanica*	Canopy	FACW
6.	*Quercus laurifolia*	Canopy	FACW
7.	*Carpinus caroliniana*	Sapling	FAC
8.	*Liquidambar sytraciflua*	Sapling	FAC+
9.	*Ilex decidua*	Shrub	FACW-
10.	*Commelina virginica*	Herb	FACW
11.	*Carex* spp.	Herb	FAC to OBL
12.	*Leersia lenticularis*	Herb	OBL
13.	*Boehmeria cylindrica*	Herb	FACW+
14.	*Campsis radicans*	Herb	FAC
15.	*Smilax rotundifolia*	FAC	FAC

Percent of Dominant Species that are OBL, FACW, or FAC (except FAC-) = **100%**

REFERENCE GAUGE 2

	Dominant Plant Species	Stratum	Indicator
1.	*Quercus lyrata*	Canopy	OBL
2.	*Quercus phellos*	Canopy	FACW-
3.	*Acer rubrum*	Canopy	FAC
4.	*Liquidambar sytraciflua*	Canopy	FAC+
5.	*Carpinus caroliniana*	Sapling	FAC
6.	*Ulmus rubra*	Sapling	FAC
7.	*Ilex decidua*	Shrub	FACW-
8.	*Crataegus* sp.	Shrub	FAC to OBL
9.	*Carex* spp.	Herb	FACW+
10.	*Fraxinus pennsylvanica*	Herb	FACW
11.	*Commelina virginica*	Herb	FACW
12.	*Leersia lenticularis*	Herb	OBL
13.	*Smilax rotundifolia*	Herb	FAC
14.	*Saururus cernuus*	Herb	OBL

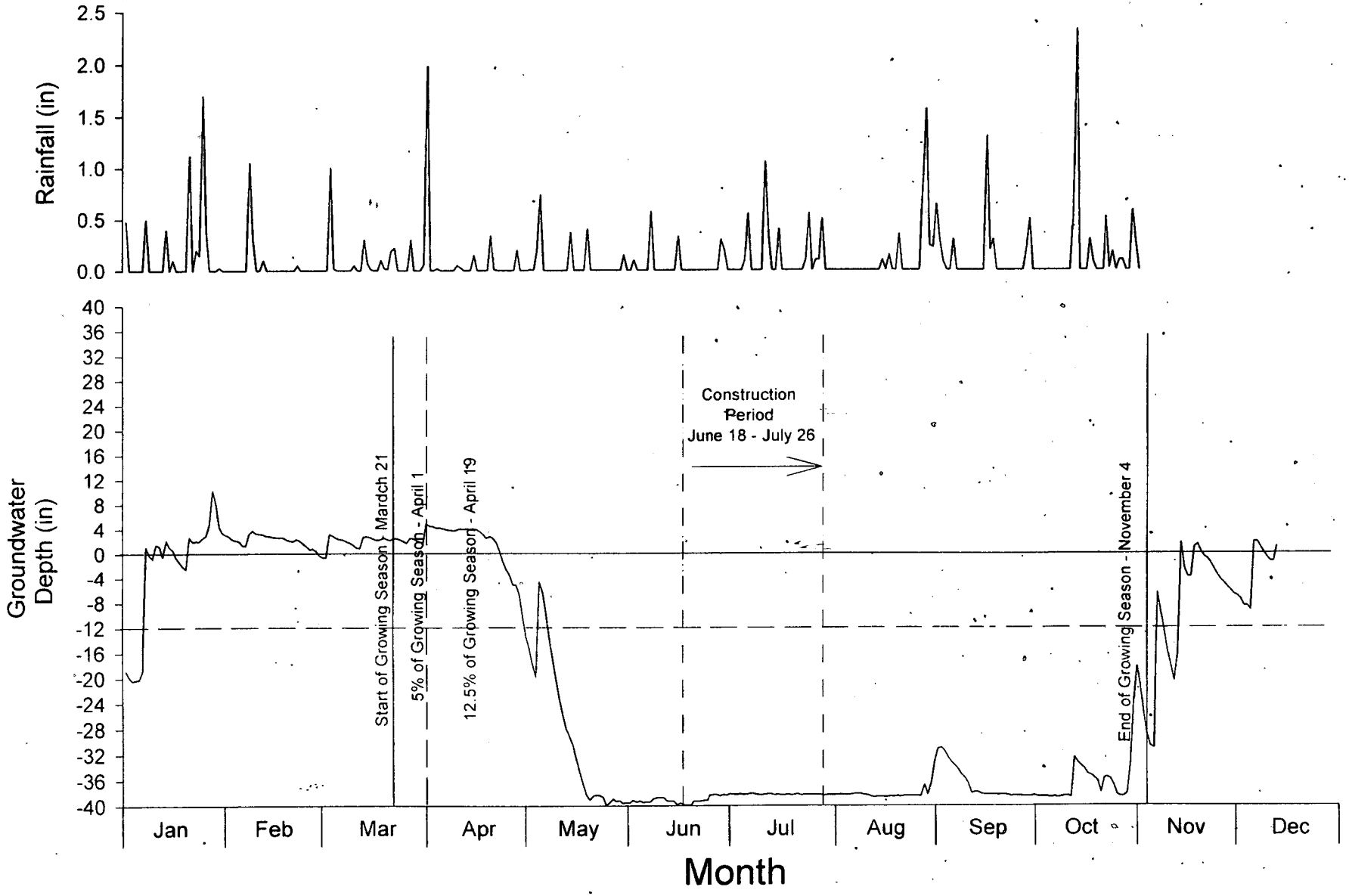
Percent of Dominant Species that are OBL, FACW, or FAC (except FAC-) = **100%**

APPENDIX D

YEAR 1 (2002) GROUNDWATER GAUGE GRAPHS

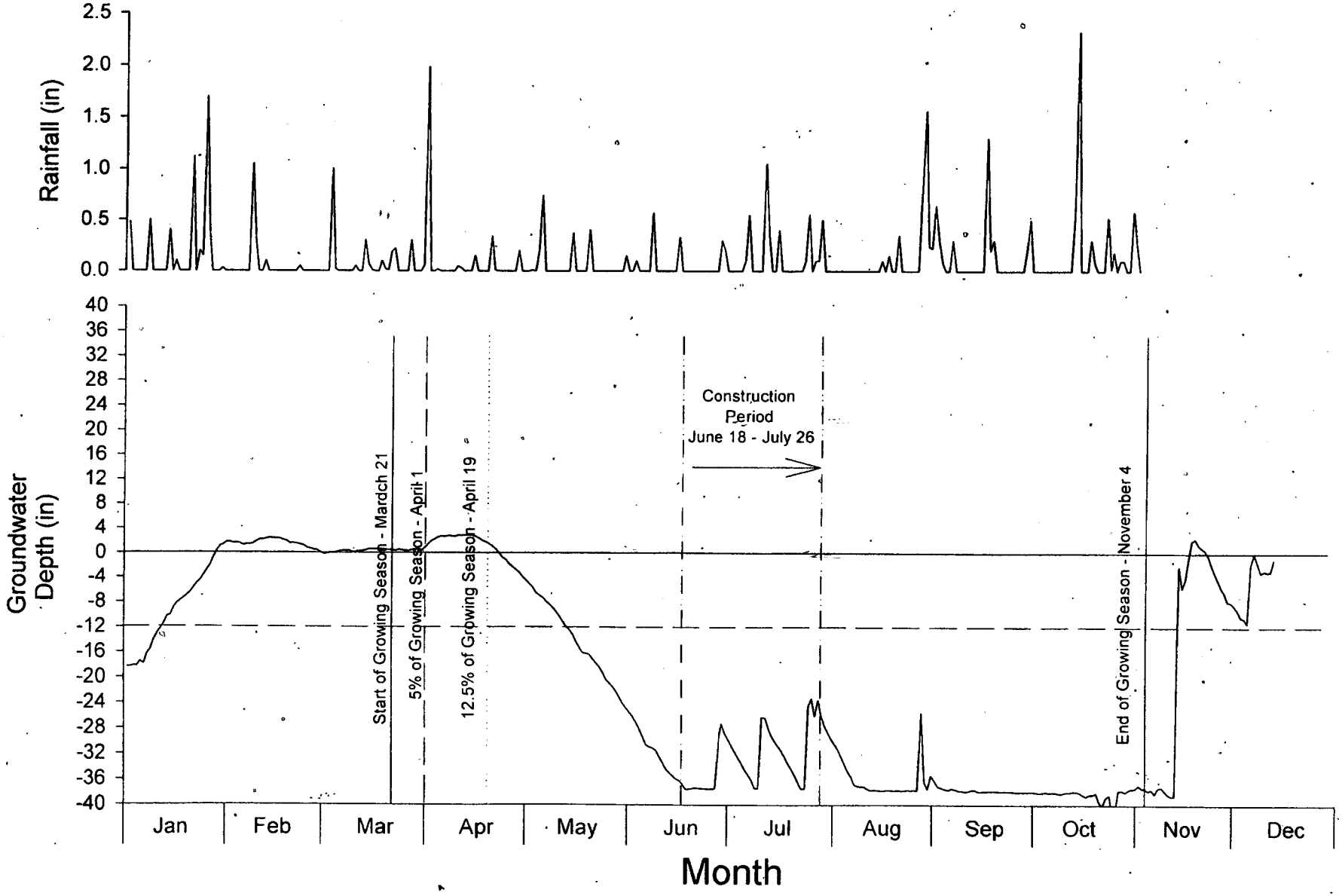
Howell Woods Wells 2002

Infinity - Reference Well 1 N3B6A9F1



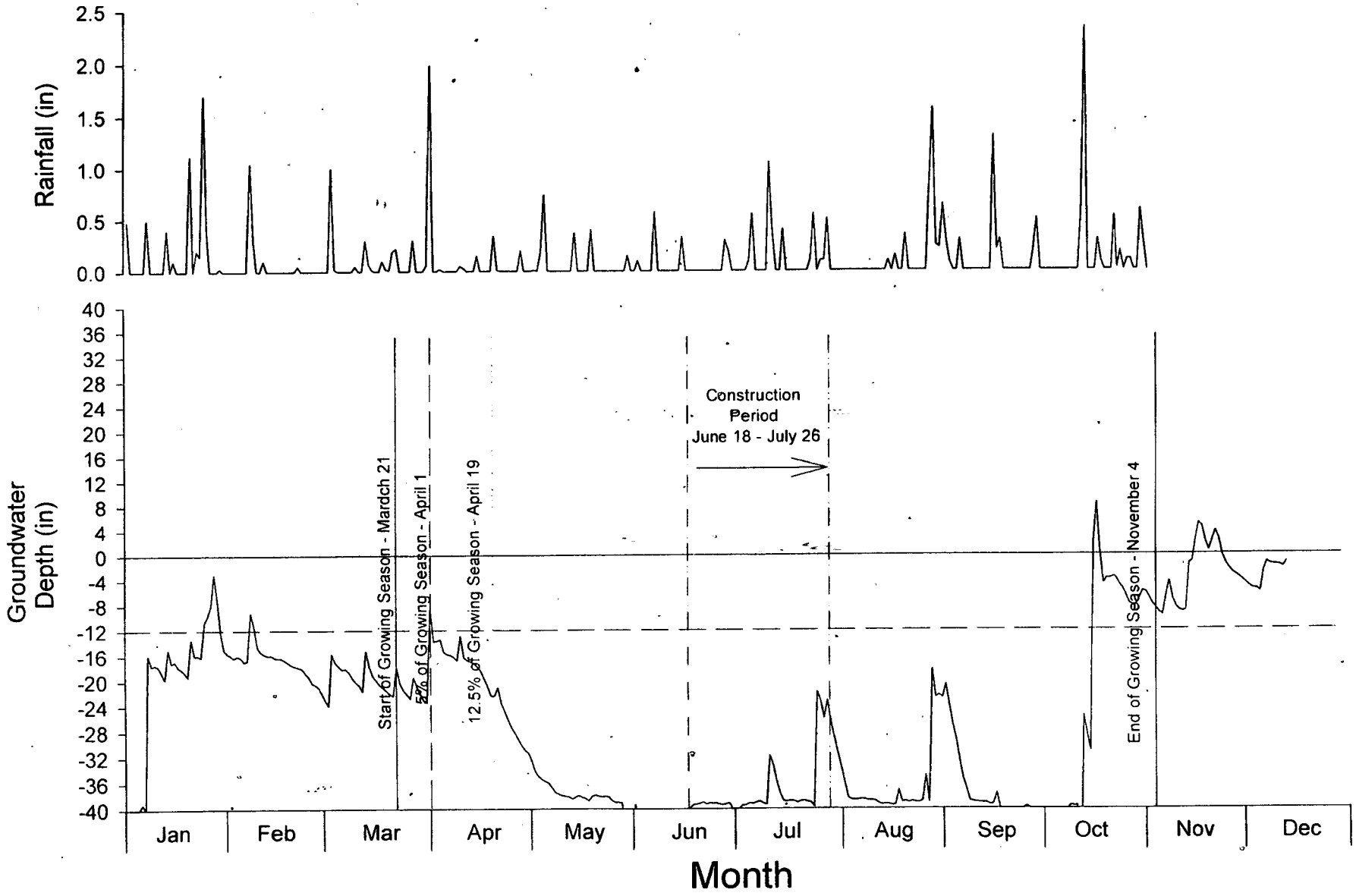
Howell Woods Wells 2002

Infinity - Reference Well 2 N3B6AA64



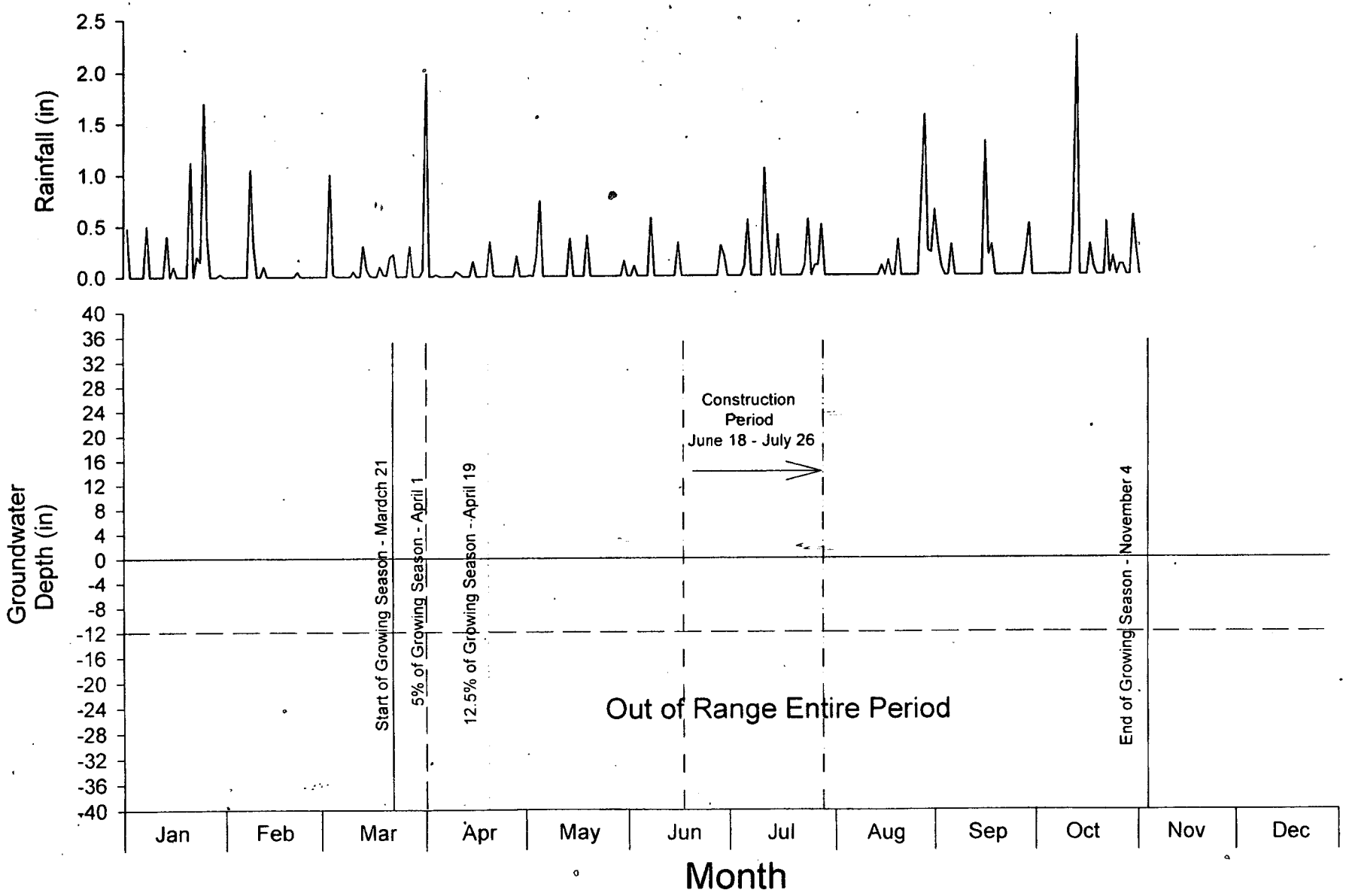
Howell Woods Wells 2002

Infinity - Well 1 N38F3506



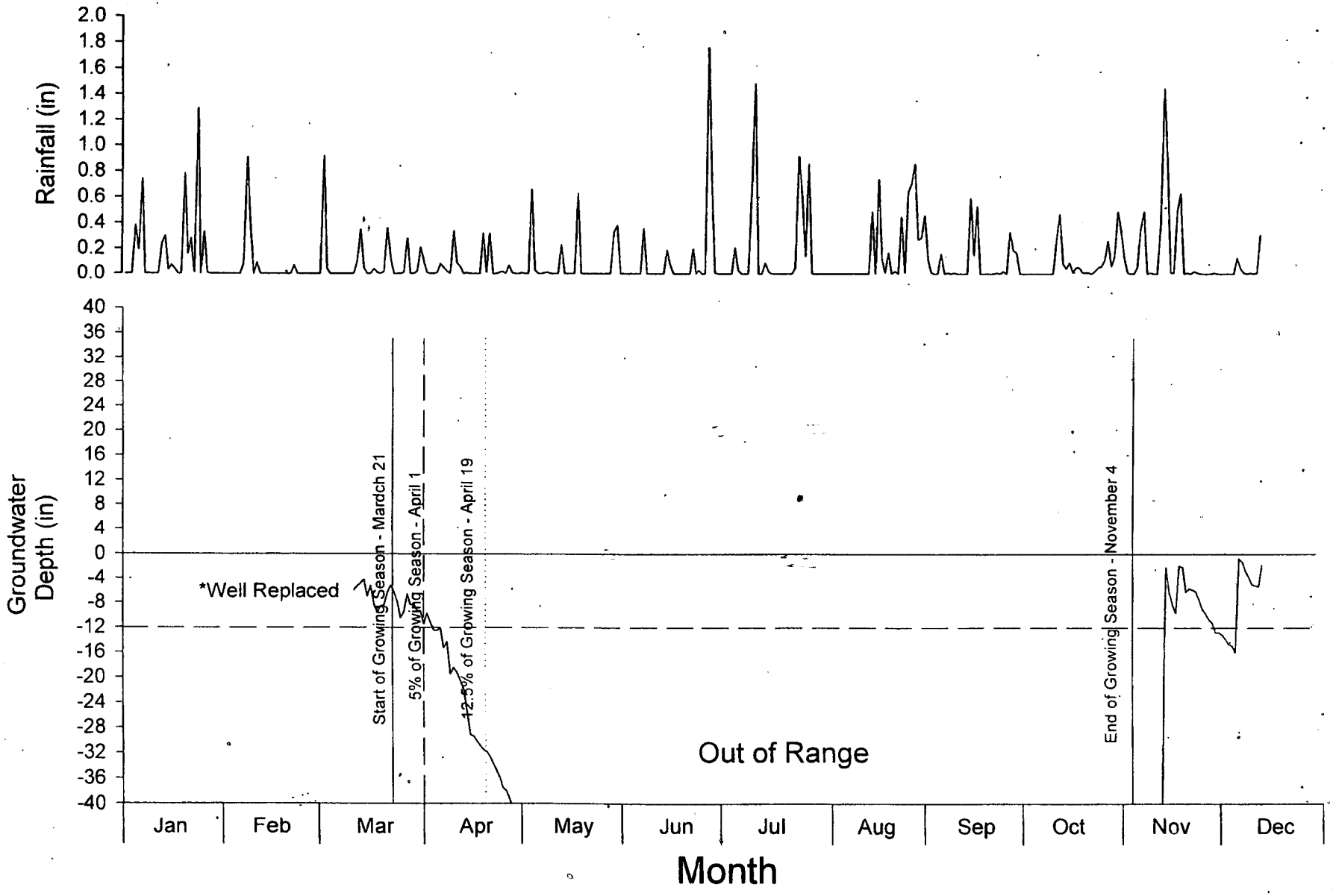
Howell Woods Wells 2002

Infinity - Well 2 N38E2621



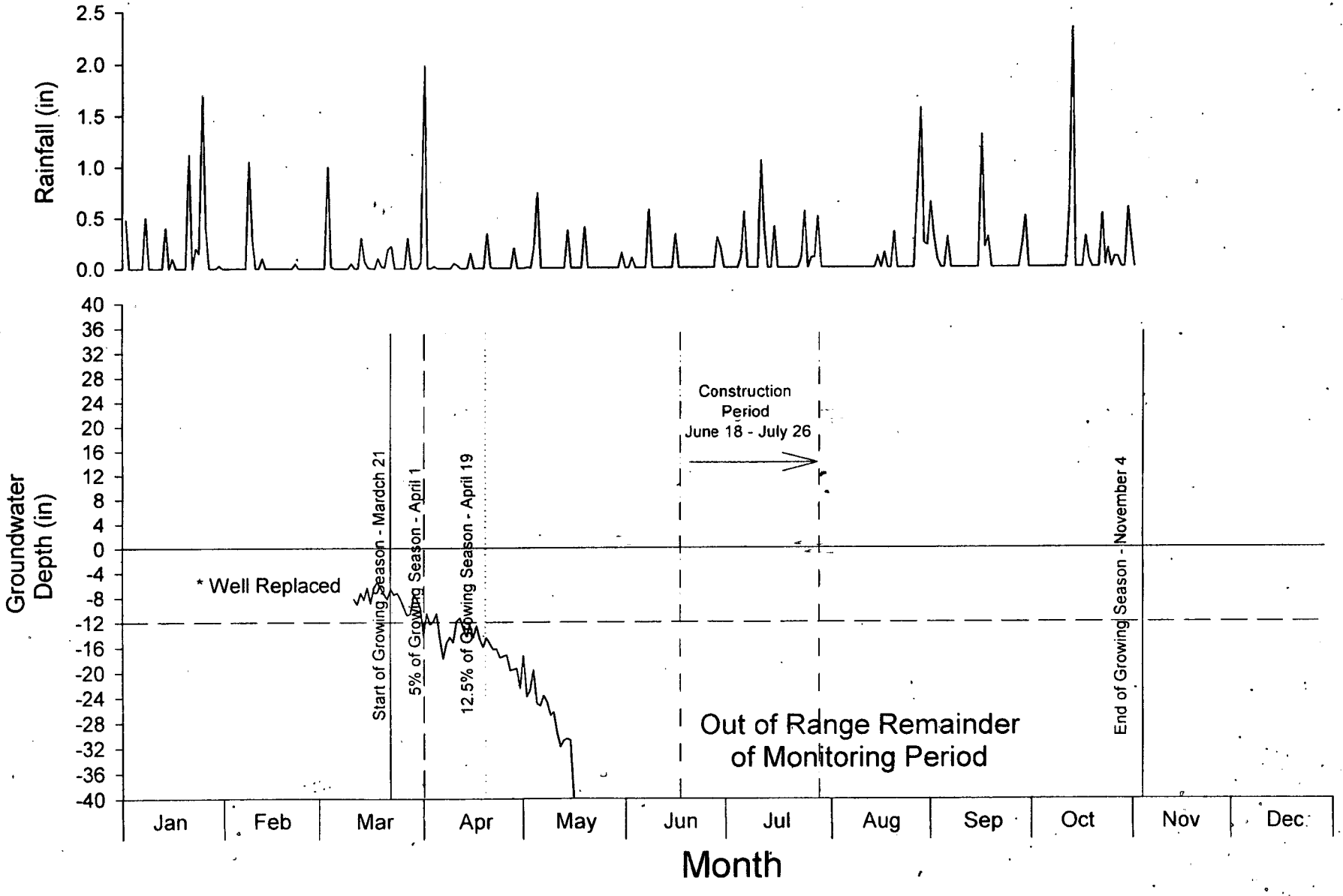
Howell Woods Wells 2002

Infinity - Well 3 N3830091



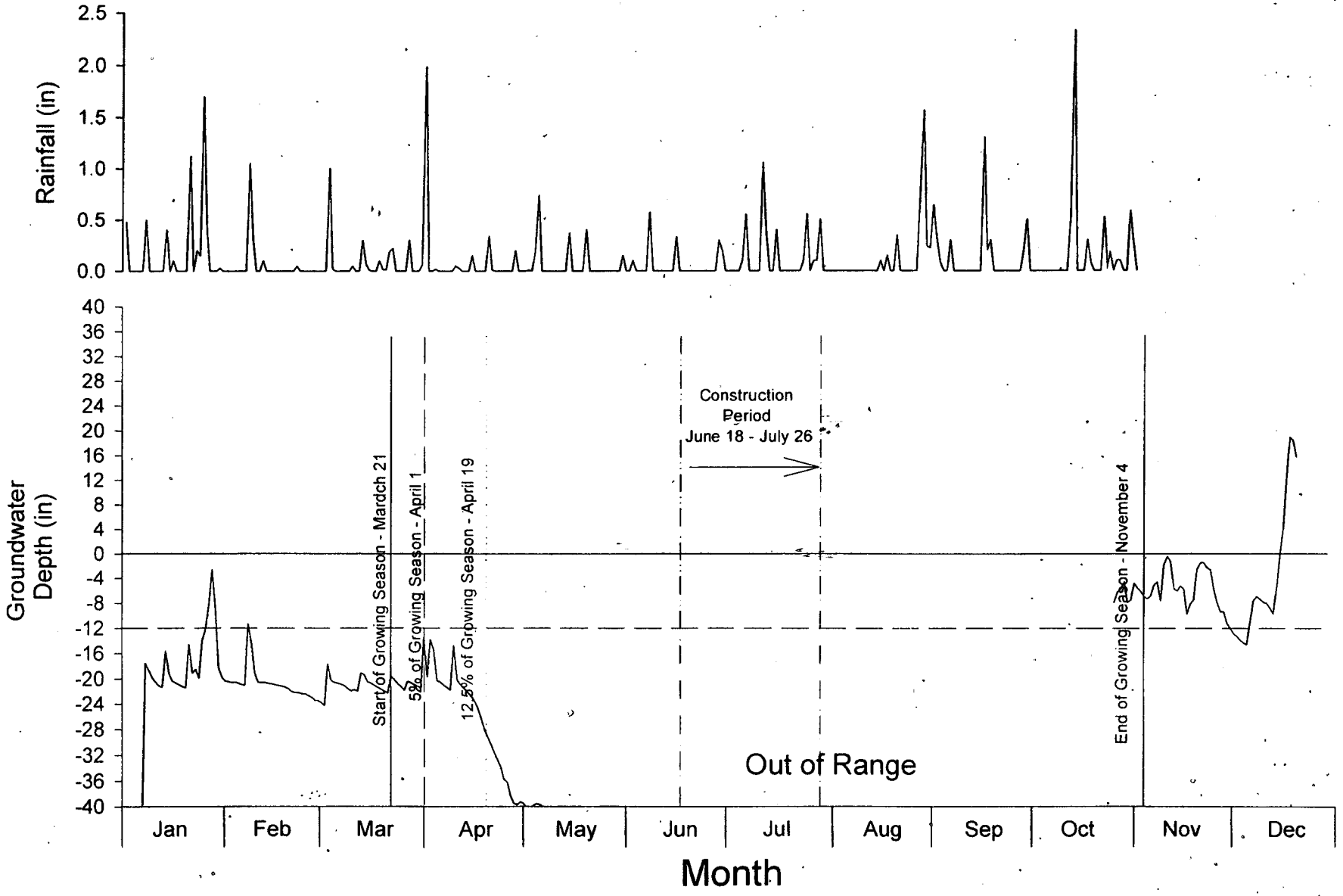
Howell Woods Wells 2002

Infinity - Well 4 N384E842



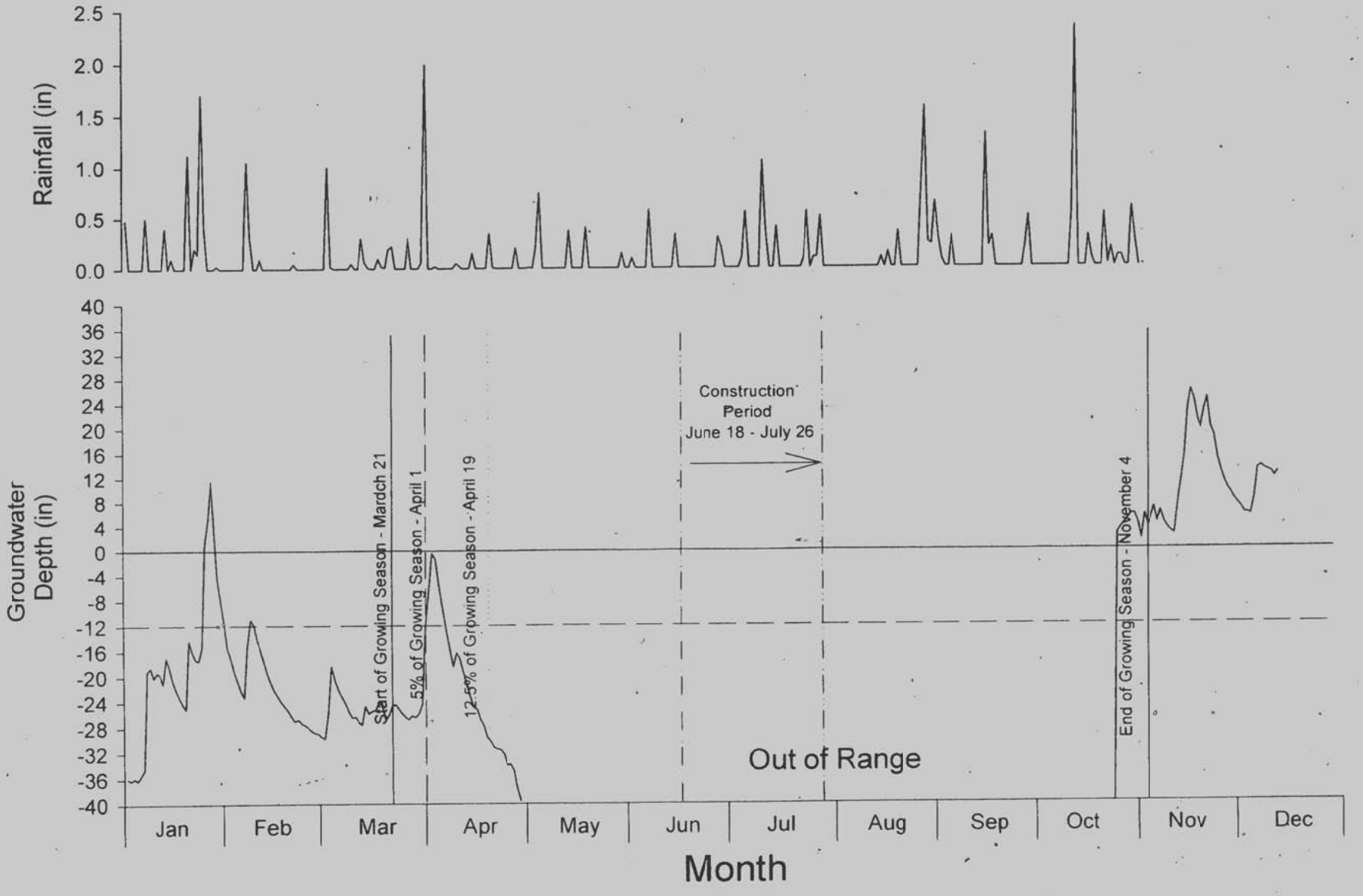
Howell Woods Wells 2002

Infinity - Well 5 N31E5851



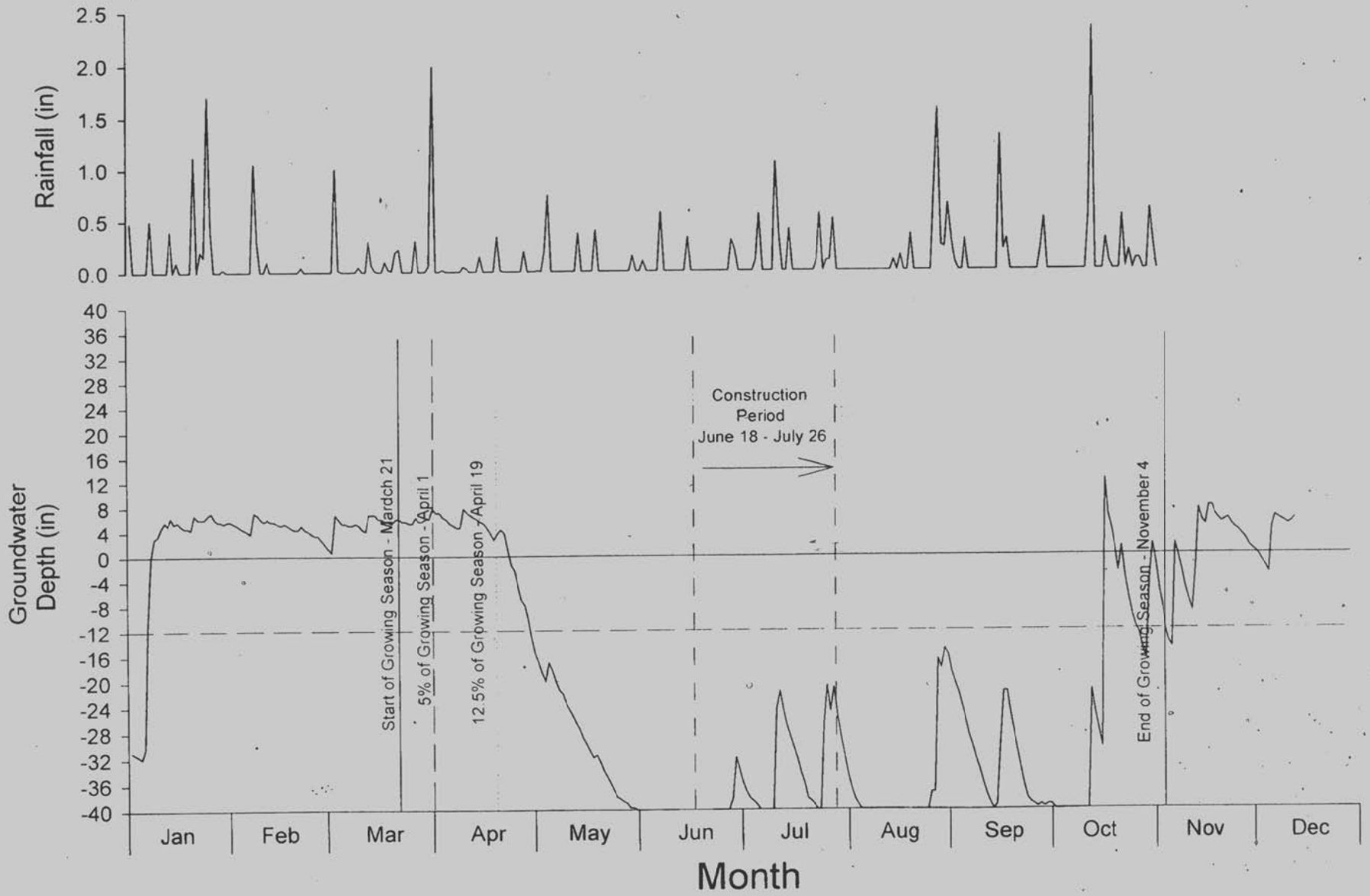
Howell Woods Wells 2002

Infinity - Well 6 N38E4C8E

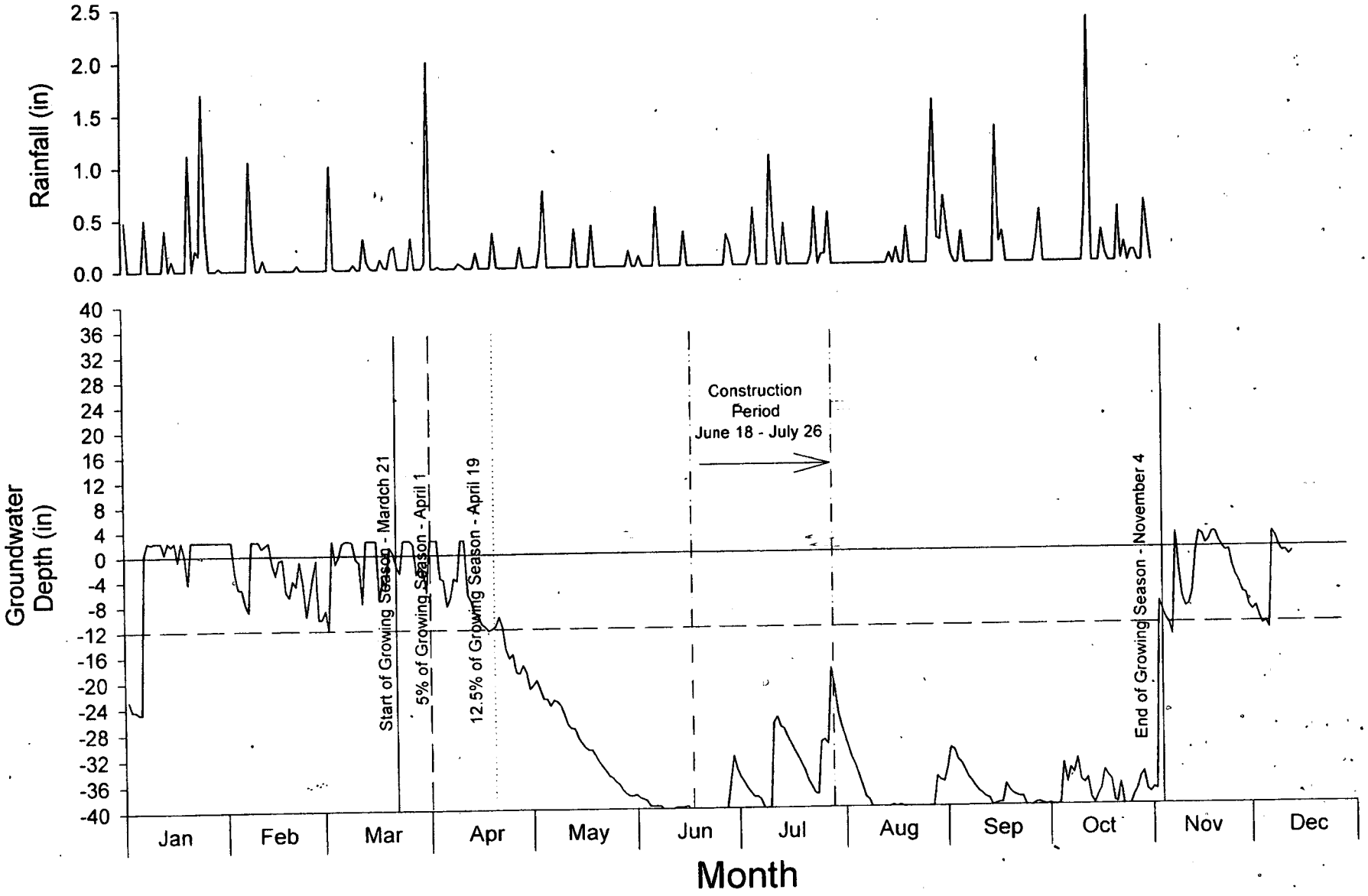


Howell Woods Wells 2002

RDS - Well A S2C9894

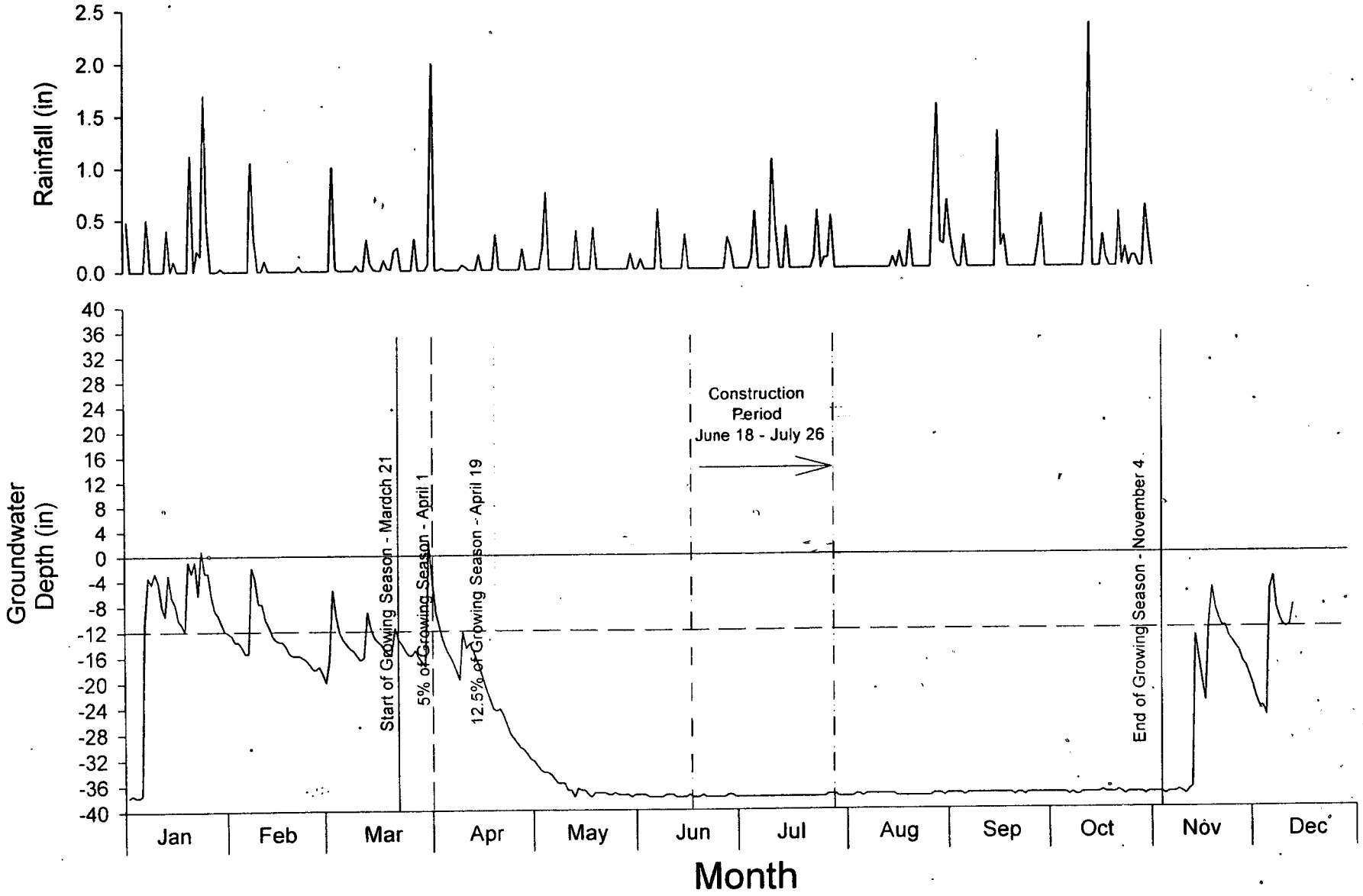


Howell Woods Wells 2002
RDS - Well B S2EAD22



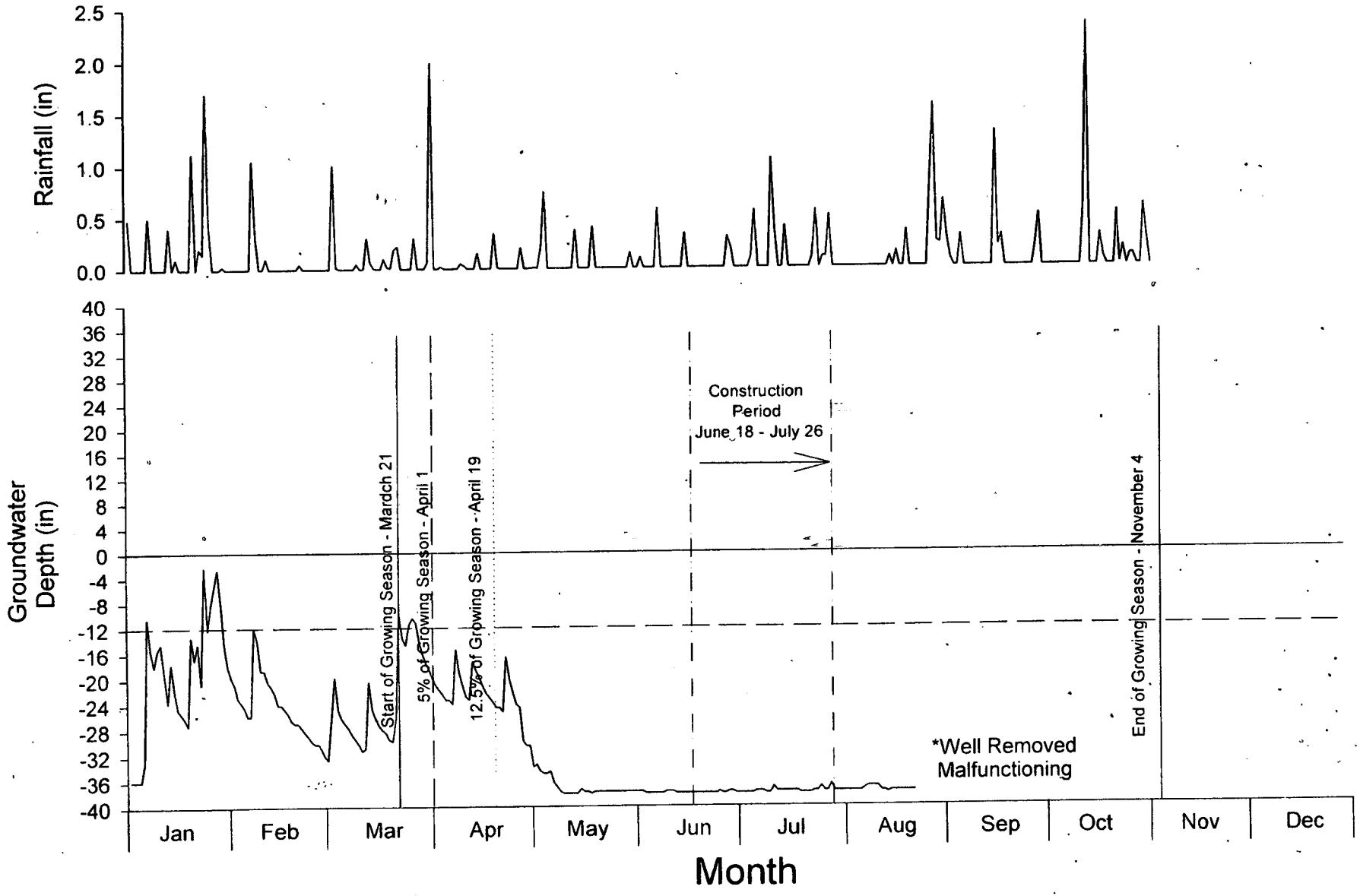
Howell Woods Wells 2002

RDS - Well C S32EAD39



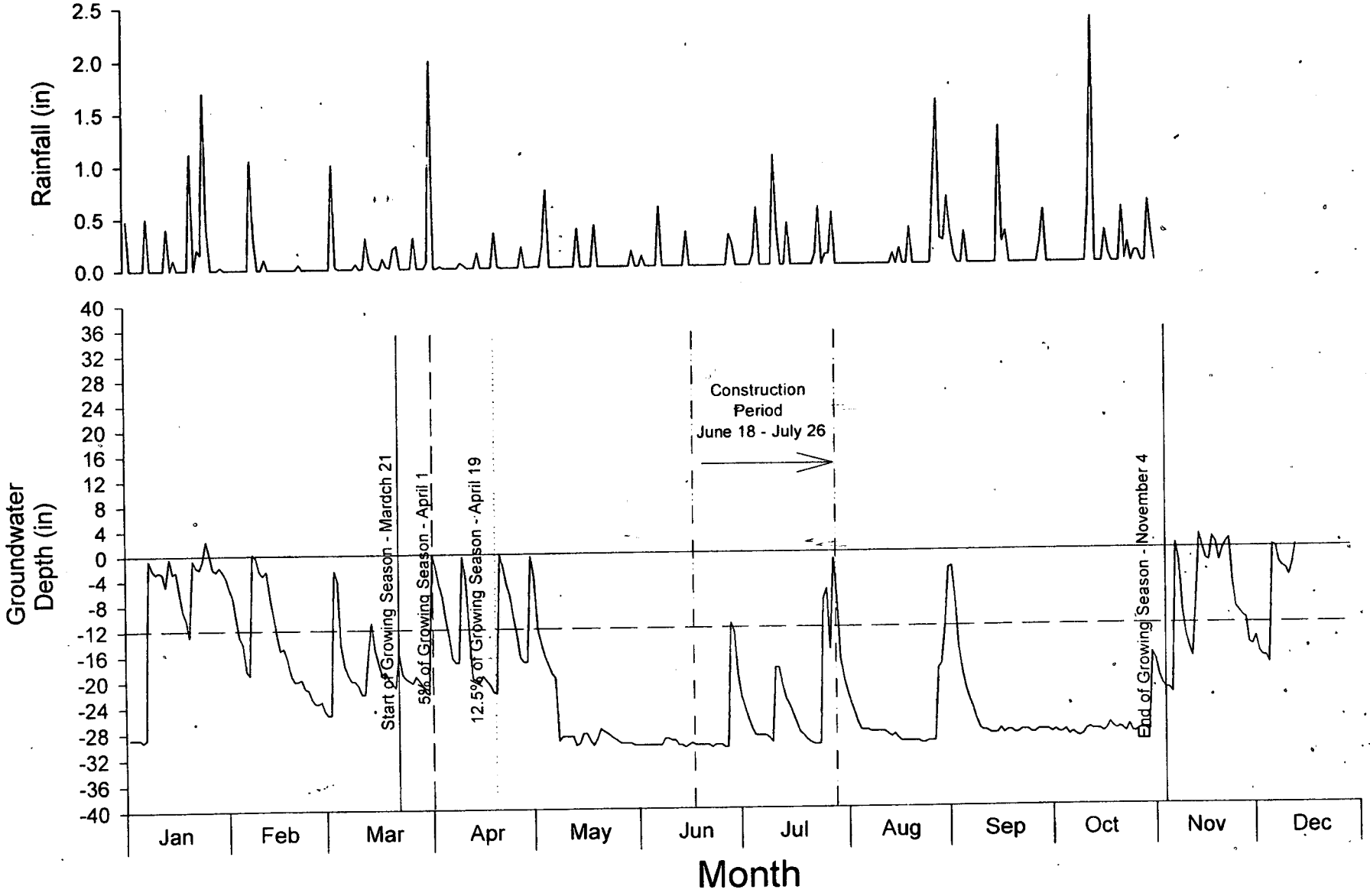
Howell Woods Wells 2002

RDS - Well D S32883A



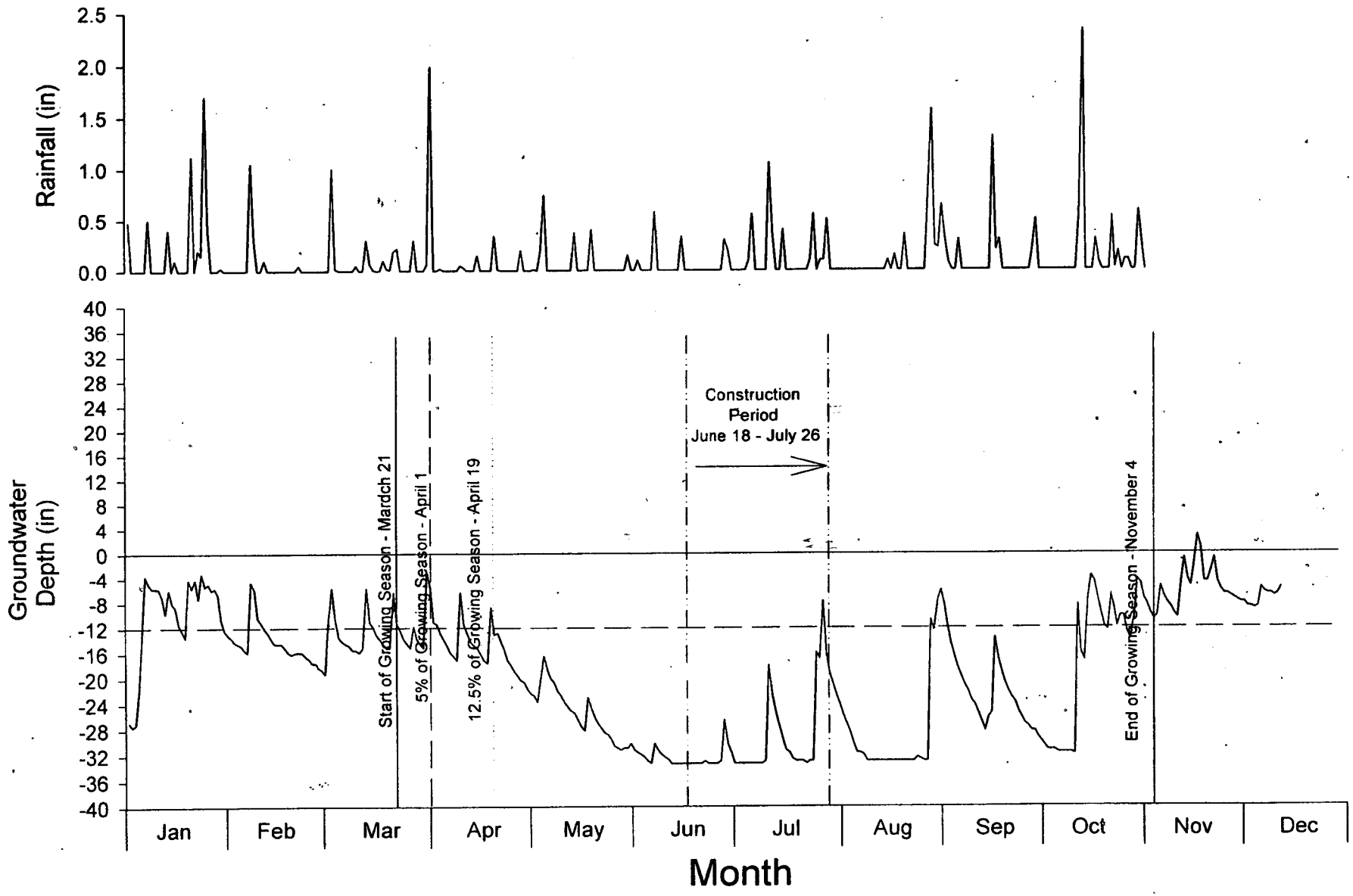
Howell Woods Wells 2002

RDS - Well E S2EAC06



Howell Woods Wells 2002

RDS - Well F S2C981D



APPENDIX E

YEAR 2 (2003) GROUNDWATER GAUGE GRAPHS

Howell Woods 2003
Infinity Well 1 N38F3506

Date	Time	Reading
01-Jan-2003	08:00:00	11.85
01-Jan-2003	20:00:00	11.77
02-Jan-2003	08:00:00	11.3
02-Jan-2003	20:00:00	11.03
03-Jan-2003	08:00:00	11.5
03-Jan-2003	20:00:00	12
04-Jan-2003	08:00:00	11.69
04-Jan-2003	20:00:00	10.24
05-Jan-2003	08:00:00	8.52
05-Jan-2003	20:00:00	5.78
06-Jan-2003	08:00:00	3.23
06-Jan-2003	20:00:00	1.39
07-Jan-2003	08:00:00	0.45
07-Jan-2003	20:00:00	-0.25
08-Jan-2003	08:00:00	-0.21
08-Jan-2003	20:00:00	-0.37
09-Jan-2003	08:00:00	-0.45
09-Jan-2003	20:00:00	-0.92
10-Jan-2003	08:00:00	-0.68
10-Jan-2003	20:00:00	-1.39
11-Jan-2003	08:00:00	-1.15
11-Jan-2003	20:00:00	-1.78
12-Jan-2003	08:00:00	-1.74
12-Jan-2003	20:00:00	-2.09
13-Jan-2003	08:00:00	-1.97
13-Jan-2003	20:00:00	-2.29
14-Jan-2003	08:00:00	-2.33
14-Jan-2003	20:00:00	-2.8
15-Jan-2003	08:00:00	-2.64
15-Jan-2003	20:00:00	-3.19
16-Jan-2003	08:00:00	-3.07
16-Jan-2003	20:00:00	-3.07
17-Jan-2003	08:00:00	-2.91
17-Jan-2003	20:00:00	-3.19
18-Jan-2003	08:00:00	-2.48
18-Jan-2003	20:00:00	-3.54
19-Jan-2003	08:00:00	-3.46
19-Jan-2003	20:00:00	-3.74
20-Jan-2003	08:00:00	-3.66
20-Jan-2003	20:00:00	-4.13
21-Jan-2003	08:00:00	-3.62
21-Jan-2003	20:00:00	-3.85
22-Jan-2003	08:00:00	-4.17
22-Jan-2003	20:00:00	-4.56
23-Jan-2003	08:00:00	-4.44
23-Jan-2003	20:00:00	-4.44
24-Jan-2003	08:00:00	-3.85
24-Jan-2003	20:00:00	-5.07
25-Jan-2003	08:00:00	-3.77
25-Jan-2003	20:00:00	-4.91
26-Jan-2003	08:00:00	-4.21
26-Jan-2003	20:00:00	-4.95
27-Jan-2003	08:00:00	-4.87
27-Jan-2003	20:00:00	-5.18
28-Jan-2003	08:00:00	-4.17
28-Jan-2003	20:00:00	-5.54
29-Jan-2003	08:00:00	-5.07
29-Jan-2003	20:00:00	-4.95
30-Jan-2003	08:00:00	-4.36

30-Jan-2003	20:00:00	-3.62
31-Jan-2003	08:00:00	-3.38
31-Jan-2003	20:00:00	-3.27
01-Feb-2003	08:00:00	-3.23
01-Feb-2003	20:00:00	-3.54
02-Feb-2003	08:00:00	-3.5
02-Feb-2003	20:00:00	-4.13
03-Feb-2003	08:00:00	-3.85
03-Feb-2003	20:00:00	-4.24
04-Feb-2003	08:00:00	-3.74
04-Feb-2003	20:00:00	-4.4
05-Feb-2003	08:00:00	-4.24
05-Feb-2003	20:00:00	-4.52
06-Feb-2003	08:00:00	-4.28
06-Feb-2003	20:00:00	-3.46
07-Feb-2003	08:00:00	-1.5
07-Feb-2003	20:00:00	-1.54
08-Feb-2003	08:00:00	-1.35
08-Feb-2003	20:00:00	-0.99
09-Feb-2003	08:00:00	1.43
09-Feb-2003	20:00:00	4.96
10-Feb-2003	08:00:00	9.07
10-Feb-2003	20:00:00	11.53
11-Feb-2003	08:00:00	11.69
11-Feb-2003	20:00:00	11.14
12-Feb-2003	08:00:00	10.91
12-Feb-2003	20:00:00	10.16
13-Feb-2003	08:00:00	9.62
13-Feb-2003	20:00:00	8.64
14-Feb-2003	08:00:00	7.74
14-Feb-2003	20:00:00	6.29
15-Feb-2003	08:00:00	5.15
15-Feb-2003	20:00:00	3.19
16-Feb-2003	08:00:00	1.04
16-Feb-2003	20:00:00	0.85
17-Feb-2003	08:00:00	2.14
17-Feb-2003	20:00:00	2.33
18-Feb-2003	08:00:00	1.71
18-Feb-2003	20:00:00	1.04
19-Feb-2003	08:00:00	0.96
19-Feb-2003	20:00:00	0.57
20-Feb-2003	08:00:00	0.57
20-Feb-2003	20:00:00	0.06
21-Feb-2003	08:00:00	0.22
21-Feb-2003	20:00:00	-0.25
22-Feb-2003	08:00:00	0.02
22-Feb-2003	20:00:00	0.57
23-Feb-2003	08:00:00	0.73
23-Feb-2003	20:00:00	0.1
24-Feb-2003	08:00:00	1.71
24-Feb-2003	20:00:00	5.7
25-Feb-2003	08:00:00	9.19
25-Feb-2003	20:00:00	11.53
26-Feb-2003	08:00:00	12.83
26-Feb-2003	20:00:00	12.9
27-Feb-2003	08:00:00	13.37
27-Feb-2003	20:00:00	15.06
28-Feb-2003	08:00:00	15.06
28-Feb-2003	20:00:00	14.51
01-Mar-2003	08:00:00	14.71
01-Mar-2003	20:00:00	18.58
02-Mar-2003	08:00:00	25.86
02-Mar-2003	20:00:00	27.82
03-Mar-2003	08:00:00	26.8

03-Mar-2003	20:00:00	25.51
04-Mar-2003	08:00:00	24.85
04-Mar-2003	20:00:00	23.99
05-Mar-2003	08:00:00	22.93
05-Mar-2003	20:00:00	21.99
06-Mar-2003	08:00:00	22.58
06-Mar-2003	20:00:00	23.67
07-Mar-2003	08:00:00	24.46
07-Mar-2003	20:00:00	28.17
08-Mar-2003	08:00:00	32.52
08-Mar-2003	20:00:00	34.2
09-Mar-2003	08:00:00	32.79
09-Mar-2003	20:00:00	29.43
10-Mar-2003	08:00:00	25.67
10-Mar-2003	20:00:00	21.83
11-Mar-2003	08:00:00	18.78
11-Mar-2003	20:00:00	16.12
12-Mar-2003	08:00:00	14.12
12-Mar-2003	20:00:00	12.28
13-Mar-2003	08:00:00	11.65
13-Mar-2003	20:00:00	10.79
14-Mar-2003	08:00:00	11.1
14-Mar-2003	20:00:00	11.1
15-Mar-2003	08:00:00	11.85
15-Mar-2003	20:00:00	13.02
16-Mar-2003	08:00:00	15.49
16-Mar-2003	20:00:00	17.37
17-Mar-2003	08:00:00	19.17
17-Mar-2003	20:00:00	20.42
18-Mar-2003	08:00:00	21.52
18-Mar-2003	20:00:00	21.75
19-Mar-2003	08:00:00	21.28
19-Mar-2003	20:00:00	20.77
20-Mar-2003	08:00:00	21.68
20-Mar-2003	20:00:00	26.65
21-Mar-2003	08:00:00	29.19
21-Mar-2003	20:00:00	32.29
22-Mar-2003	08:00:00	36.67
22-Mar-2003	20:00:00	41.45
23-Mar-2003	08:00:00	42.74
23-Mar-2003	20:00:00	39.96
24-Mar-2003	08:00:00	35.77
24-Mar-2003	20:00:00	30.64
25-Mar-2003	08:00:00	25.28
25-Mar-2003	20:00:00	20.46
26-Mar-2003	08:00:00	16.62
26-Mar-2003	20:00:00	13.61
27-Mar-2003	08:00:00	11.61
27-Mar-2003	20:00:00	10.28
28-Mar-2003	08:00:00	9.69
28-Mar-2003	20:00:00	9.85
29-Mar-2003	08:00:00	10.01
29-Mar-2003	20:00:00	11.14
30-Mar-2003	08:00:00	10.79
30-Mar-2003	20:00:00	11.97
31-Mar-2003	08:00:00	12.63
31-Mar-2003	20:00:00	13.73
01-Apr-2003	08:00:00	16.23
01-Apr-2003	20:00:00	17.33
02-Apr-2003	08:00:00	16.23
02-Apr-2003	20:00:00	14.82
03-Apr-2003	08:00:00	14.39
03-Apr-2003	20:00:00	14.67
04-Apr-2003	08:00:00	15.72

04-Apr-2003	20:00:00	16.7
05-Apr-2003	08:00:00	17.45
05-Apr-2003	20:00:00	17.64
06-Apr-2003	08:00:00	17.52
06-Apr-2003	20:00:00	17.29
07-Apr-2003	08:00:00	17.21
07-Apr-2003	20:00:00	18.62
08-Apr-2003	08:00:00	18.97
08-Apr-2003	20:00:00	19.44
09-Apr-2003	08:00:00	22.42
09-Apr-2003	20:00:00	23.32
10-Apr-2003	08:00:00	23.59
10-Apr-2003	20:00:00	24.96
11-Apr-2003	08:00:00	29.7
11-Apr-2003	20:00:00	35.85
12-Apr-2003	08:00:00	42.03
12-Apr-2003	20:00:00	44.97
13-Apr-2003	08:00:00	45.21
13-Apr-2003	20:00:00	43.41
14-Apr-2003	08:00:00	40.63
14-Apr-2003	20:00:00	37.22
15-Apr-2003	08:00:00	33.5
15-Apr-2003	20:00:00	29.39
16-Apr-2003	08:00:00	25.63
16-Apr-2003	20:00:00	22.65
17-Apr-2003	08:00:00	20.58
17-Apr-2003	20:00:00	18.82
18-Apr-2003	08:00:00	17.8
18-Apr-2003	20:00:00	17.56
19-Apr-2003	08:00:00	18.54
19-Apr-2003	20:00:00	20.7
20-Apr-2003	08:00:00	23.59
20-Apr-2003	20:00:00	25.9
21-Apr-2003	08:00:00	28.17
21-Apr-2003	20:00:00	30.01
22-Apr-2003	08:00:00	31.7
22-Apr-2003	20:00:00	32.29
23-Apr-2003	08:00:00	32.87
23-Apr-2003	20:00:00	33.15
24-Apr-2003	08:00:00	33.42
24-Apr-2003	20:00:00	33.3
25-Apr-2003	08:00:00	33.19
25-Apr-2003	20:00:00	33.54
26-Apr-2003	08:00:00	32.99
26-Apr-2003	20:00:00	32.29
27-Apr-2003	08:00:00	31.58
27-Apr-2003	20:00:00	30.6
28-Apr-2003	08:00:00	30.25
28-Apr-2003	20:00:00	30.29
29-Apr-2003	08:00:00	30.84
29-Apr-2003	20:00:00	30.88
30-Apr-2003	08:00:00	30.56
30-Apr-2003	20:00:00	29.78
01-May-2003	08:00:00	28.92
01-May-2003	20:00:00	27.67
02-May-2003	08:00:00	26.53
02-May-2003	20:00:00	24.81
03-May-2003	08:00:00	23.2
03-May-2003	20:00:00	21.64
04-May-2003	08:00:00	20.38
04-May-2003	20:00:00	18.7
05-May-2003	08:00:00	16.66
05-May-2003	20:00:00	13.96
06-May-2003	08:00:00	12.36

06-May-2003	20:00:00	10.4
07-May-2003	08:00:00	8.6
07-May-2003	20:00:00	6.88
08-May-2003	08:00:00	5.78
08-May-2003	20:00:00	3.9
09-May-2003	08:00:00	3.04
09-May-2003	20:00:00	1.47
10-May-2003	08:00:00	1.08
10-May-2003	20:00:00	0.41
11-May-2003	08:00:00	0.41
11-May-2003	20:00:00	0.02
12-May-2003	08:00:00	-0.09
12-May-2003	20:00:00	-0.49
13-May-2003	08:00:00	-0.49
13-May-2003	20:00:00	-1.03
14-May-2003	08:00:00	-1.15
14-May-2003	20:00:00	-1.86
15-May-2003	08:00:00	-1.86
15-May-2003	20:00:00	-2.6
16-May-2003	08:00:00	-2.76
16-May-2003	20:00:00	-3.19
17-May-2003	08:00:00	-3.54
17-May-2003	20:00:00	-4.05
18-May-2003	08:00:00	-4.28
18-May-2003	20:00:00	-4.64
19-May-2003	08:00:00	-3.66
19-May-2003	20:00:00	-2.6
20-May-2003	08:00:00	-2.76
20-May-2003	20:00:00	-3.46
21-May-2003	08:00:00	-3.54
21-May-2003	20:00:00	-4.13
22-May-2003	08:00:00	-3.85
22-May-2003	20:00:00	-3.7
23-May-2003	08:00:00	-1.43
23-May-2003	20:00:00	-1.07
24-May-2003	08:00:00	-0.96
24-May-2003	20:00:00	-1.15
25-May-2003	08:00:00	-0.96
25-May-2003	20:00:00	1.9
26-May-2003	08:00:00	10.71
26-May-2003	20:00:00	8.52
27-May-2003	08:00:00	8.79
27-May-2003	20:00:00	8.99
28-May-2003	08:00:00	8.52
28-May-2003	20:00:00	7.58
29-May-2003	08:00:00	7.97
29-May-2003	20:00:00	8.09
30-May-2003	08:00:00	8.32
30-May-2003	20:00:00	8.13
31-May-2003	08:00:00	8.75
31-May-2003	20:00:00	12
01-Jun-2003	08:00:00	12.63
01-Jun-2003	20:00:00	12.98
02-Jun-2003	08:00:00	14.78

Howell Woods 2003
Infinity Well 3 N3830091

Date	Time	Reading	Day
01-Jan-2003	08:00:00	-0.62	
02-Jan-2003	08:00:00	-0.62	
03-Jan-2003	08:00:00	-0.47	
04-Jan-2003	08:00:00	-0.39	
05-Jan-2003	08:00:00	-0.98	
06-Jan-2003	08:00:00	-1.06	
07-Jan-2003	08:00:00	-1.25	
08-Jan-2003	08:00:00	-1.02	
09-Jan-2003	08:00:00	-1.29	
10-Jan-2003	08:00:00	-1.68	
11-Jan-2003	08:00:00	-2.62	
12-Jan-2003	08:00:00	-3.6	
13-Jan-2003	08:00:00	-3.64	
14-Jan-2003	08:00:00	-4.54	
15-Jan-2003	08:00:00	-5.05	
16-Jan-2003	08:00:00	-5.44	
17-Jan-2003	08:00:00	-1.41	
18-Jan-2003	08:00:00	-2.7	
19-Jan-2003	08:00:00	-4.23	
20-Jan-2003	08:00:00	-4.93	
21-Jan-2003	08:00:00	-5.32	
22-Jan-2003	08:00:00	-4.85	
23-Jan-2003	08:00:00	-5.48	
24-Jan-2003	08:00:00	-4.62	
25-Jan-2003	08:00:00	-4.54	
26-Jan-2003	08:00:00	-5.48	
27-Jan-2003	08:00:00	-5.44	
28-Jan-2003	08:00:00	-5.24	
29-Jan-2003	08:00:00	-5.6	
30-Jan-2003	08:00:00	-2.54	
31-Jan-2003	08:00:00	-0.51	
01-Feb-2003	08:00:00	-1.21	
02-Feb-2003	08:00:00	-1.99	
03-Feb-2003	08:00:00	-2.74	
04-Feb-2003	08:00:00	-2.43	
05-Feb-2003	08:00:00	-3.13	
06-Feb-2003	08:00:00	-4.81	
07-Feb-2003	08:00:00	0.04	
08-Feb-2003	08:00:00	-0.86	
09-Feb-2003	08:00:00	-1.02	
10-Feb-2003	08:00:00	0.43	
11-Feb-2003	08:00:00	-0.66	
12-Feb-2003	08:00:00	-0.66	
13-Feb-2003	08:00:00	-0.98	
14-Feb-2003	08:00:00	-1.02	
15-Feb-2003	08:00:00	-0.23	
16-Feb-2003	08:00:00	-0.86	
17-Feb-2003	08:00:00	-0.31	
18-Feb-2003	08:00:00	-0.59	
19-Feb-2003	08:00:00	-0.78	
20-Feb-2003	08:00:00	-0.86	
21-Feb-2003	08:00:00	-1.02	
22-Feb-2003	08:00:00	-0.82	
23-Feb-2003	08:00:00	-0.23	
24-Feb-2003	08:00:00	-1.13	
25-Feb-2003	08:00:00	-1.21	
26-Feb-2003	08:00:00	-0.9	
27-Feb-2003	08:00:00	0.28	
28-Feb-2003	08:00:00	-0.08	

01-Mar-2003	08:00:00	-0.23	
02-Mar-2003	08:00:00	12.49	
03-Mar-2003	08:00:00	12.92	
04-Mar-2003	08:00:00	10.65	
05-Mar-2003	08:00:00	8.15	
06-Mar-2003	08:00:00	7.52	
07-Mar-2003	08:00:00	10.73	
08-Mar-2003	08:00:00	20.28	
09-Mar-2003	08:00:00	20.01	
10-Mar-2003	08:00:00	11.51	
11-Mar-2003	08:00:00	3.02	
12-Mar-2003	08:00:00	0.12	
13-Mar-2003	08:00:00	-0.12	
14-Mar-2003	08:00:00	0.12	
15-Mar-2003	08:00:00	0.08	
16-Mar-2003	08:00:00	0.24	
17-Mar-2003	08:00:00	4.03	
18-Mar-2003	08:00:00	6.81	
19-Mar-2003	08:00:00	5.09	
20-Mar-2003	08:00:00	6.93	
21-Mar-2003	08:00:00	16.17	1
22-Mar-2003	08:00:00	24.98	2
23-Mar-2003	08:00:00	31.32	3
24-Mar-2003	08:00:00	23.38	4
25-Mar-2003	08:00:00	11.2	5
26-Mar-2003	08:00:00	1.06	6
27-Mar-2003	08:00:00	0.24	7
28-Mar-2003	08:00:00	0.08	8
29-Mar-2003	08:00:00	0.24	9
30-Mar-2003	08:00:00	0.2	10
31-Mar-2003	08:00:00	0.39	11
01-Apr-2003	08:00:00	1.53	12
02-Apr-2003	08:00:00	0.79	13
03-Apr-2003	08:00:00	0.32	14
04-Apr-2003	08:00:00	0.59	15
05-Apr-2003	08:00:00	2.31	16
06-Apr-2003	08:00:00	2.23	17
07-Apr-2003	08:00:00	1.8	18
08-Apr-2003	08:00:00	3.92	19
09-Apr-2003	08:00:00	8.42	20
10-Apr-2003	08:00:00	9.67	21
11-Apr-2003	08:00:00	17.35	22
12-Apr-2003	08:00:00	31.05	23
13-Apr-2003	08:00:00	32	24
14-Apr-2003	08:00:00	29.33	25
15-Apr-2003	08:00:00	20.95	26
16-Apr-2003	08:00:00	11.87	27
17-Apr-2003	08:00:00	5.44	28
18-Apr-2003	08:00:00	2.35	29
19-Apr-2003	08:00:00	3.45	30
20-Apr-2003	08:00:00	10.1	31
21-Apr-2003	08:00:00	15.39	32
22-Apr-2003	08:00:00	19.34	33
23-Apr-2003	08:00:00	20.75	34
24-Apr-2003	08:00:00	21.38	35
25-Apr-2003	08:00:00	20.91	36
26-Apr-2003	08:00:00	20.52	37
27-Apr-2003	08:00:00	18.87	38
28-Apr-2003	08:00:00	17.27	39
29-Apr-2003	08:00:00	18.21	40
30-Apr-2003	08:00:00	17.7	41
01-May-2003	08:00:00	11.83	42
02-May-2003	08:00:00	12.81	43
03-May-2003	08:00:00	9.09	44

04-May-2003	08:00:00	5.17	45
05-May-2003	08:00:00	1.29	46
06-May-2003	08:00:00	0.67	47
07-May-2003	08:00:00	0.12	48
08-May-2003	08:00:00	-0.62	49
09-May-2003	08:00:00	-1.6	50
10-May-2003	08:00:00	-7.16	51
11-May-2003	08:00:00	-4.15	52
12-May-2003	08:00:00	-6.97	53
13-May-2003	08:00:00	-11.23	54
14-May-2003	08:00:00	-14.21	
15-May-2003	08:00:00	-16.83	
16-May-2003	08:00:00	-17.23	
17-May-2003	08:00:00	-18.63	
18-May-2003	08:00:00	-19.1	
19-May-2003	08:00:00	-6.93	1
20-May-2003	08:00:00	-7.4	2
21-May-2003	08:00:00	-12.49	
22-May-2003	08:00:00	-12.57	
23-May-2003	08:00:00	0.55	1
24-May-2003	08:00:00	-0.98	2
25-May-2003	08:00:00	-6.97	3
26-May-2003	08:00:00	0.12	4
27-May-2003	08:00:00	0.16	5
28-May-2003	08:00:00	-0.47	6
29-May-2003	08:00:00	-1.41	7
30-May-2003	08:00:00	-1.06	8
31-May-2003	08:00:00	-7.05	9
01-Jun-2003	08:00:00	-0.15	10
02-Jun-2003	08:00:00	-1.09	11

Howell Woods 2003
Infinity Well 4 N384E842

Date	Time	Reading
01-Jan-2003	08:00:00	Out of Range
02-Jan-2003	08:00:00	0.61
03-Jan-2003	08:00:00	Out of Range
04-Jan-2003	08:00:00	Out of Range
05-Jan-2003	08:00:00	Out of Range
06-Jan-2003	08:00:00	Out of Range
07-Jan-2003	08:00:00	Out of Range
08-Jan-2003	08:00:00	Out of Range
09-Jan-2003	08:00:00	0.1
10-Jan-2003	08:00:00	-0.09
11-Jan-2003	08:00:00	Out of Range
12-Jan-2003	08:00:00	Out of Range
13-Jan-2003	08:00:00	Out of Range
14-Jan-2003	08:00:00	Out of Range
15-Jan-2003	08:00:00	Out of Range
16-Jan-2003	08:00:00	Out of Range
17-Jan-2003	08:00:00	Out of Range
18-Jan-2003	08:00:00	Out of Range
19-Jan-2003	08:00:00	Out of Range
20-Jan-2003	08:00:00	Out of Range
21-Jan-2003	08:00:00	Out of Range
22-Jan-2003	08:00:00	Out of Range
23-Jan-2003	08:00:00	Out of Range
24-Jan-2003	08:00:00	Out of Range
25-Jan-2003	08:00:00	Out of Range
26-Jan-2003	08:00:00	Out of Range
27-Jan-2003	08:00:00	Out of Range
28-Jan-2003	08:00:00	Out of Range
29-Jan-2003	08:00:00	Out of Range
30-Jan-2003	08:00:00	Out of Range
31-Jan-2003	08:00:00	Out of Range
01-Feb-2003	08:00:00	Out of Range
02-Feb-2003	08:00:00	Out of Range
03-Feb-2003	08:00:00	Out of Range
04-Feb-2003	08:00:00	-0.25
05-Feb-2003	08:00:00	Out of Range
06-Feb-2003	08:00:00	Out of Range
07-Feb-2003	08:00:00	Out of Range
08-Feb-2003	08:00:00	Out of Range
09-Feb-2003	08:00:00	Out of Range
10-Feb-2003	08:00:00	Out of Range
11-Feb-2003	08:00:00	Out of Range
12-Feb-2003	08:00:00	Out of Range
13-Feb-2003	08:00:00	Out of Range
14-Feb-2003	08:00:00	Out of Range
15-Feb-2003	08:00:00	Out of Range
16-Feb-2003	08:00:00	Out of Range
17-Feb-2003	08:00:00	Out of Range
18-Feb-2003	08:00:00	Out of Range
19-Feb-2003	08:00:00	Out of Range
20-Feb-2003	08:00:00	Out of Range
21-Feb-2003	08:00:00	Out of Range
22-Feb-2003	08:00:00	0.38
23-Feb-2003	08:00:00	1.08
24-Feb-2003	08:00:00	Out of Range
25-Feb-2003	08:00:00	Out of Range
26-Feb-2003	08:00:00	Out of Range
27-Feb-2003	08:00:00	Out of Range
28-Feb-2003	08:00:00	Out of Range

01-Mar-2003	08:00:00	Out of Range
02-Mar-2003	08:00:00	13.34
03-Mar-2003	08:00:00	Out of Range
04-Mar-2003	08:00:00	Out of Range
05-Mar-2003	08:00:00	9.26
06-Mar-2003	08:00:00	8.72
07-Mar-2003	08:00:00	Out of Range
08-Mar-2003	08:00:00	Out of Range
09-Mar-2003	08:00:00	20.7
10-Mar-2003	08:00:00	12.32
11-Mar-2003	08:00:00	Out of Range
12-Mar-2003	08:00:00	Out of Range
13-Mar-2003	08:00:00	1.08
14-Mar-2003	08:00:00	1.35
15-Mar-2003	08:00:00	Out of Range
16-Mar-2003	08:00:00	3.35
17-Mar-2003	08:00:00	5.7
18-Mar-2003	08:00:00	8.05
19-Mar-2003	08:00:00	7.62
20-Mar-2003	08:00:00	8.25
21-Mar-2003	08:00:00	Out of Range
22-Mar-2003	08:00:00	25.63
23-Mar-2003	08:00:00	32.05
24-Mar-2003	08:00:00	24.18
25-Mar-2003	08:00:00	11.93
26-Mar-2003	08:00:00	2.57
27-Mar-2003	08:00:00	1.39
28-Mar-2003	08:00:00	1.28
29-Mar-2003	08:00:00	1.32
30-Mar-2003	08:00:00	1.12
31-Mar-2003	08:00:00	Out of Range
01-Apr-2003	08:00:00	Out of Range
02-Apr-2003	08:00:00	2.96
03-Apr-2003	08:00:00	1.94
04-Apr-2003	08:00:00	3.47
05-Apr-2003	08:00:00	4.6
06-Apr-2003	08:00:00	4.53
07-Apr-2003	08:00:00	4.1
08-Apr-2003	08:00:00	5.78
09-Apr-2003	08:00:00	Out of Range
10-Apr-2003	08:00:00	Out of Range
11-Apr-2003	08:00:00	18.27
12-Apr-2003	08:00:00	31.58
13-Apr-2003	08:00:00	35.03
14-Apr-2003	08:00:00	29.74
15-Apr-2003	08:00:00	21.44
16-Apr-2003	08:00:00	12.51
17-Apr-2003	08:00:00	6.91
18-Apr-2003	08:00:00	4.25
19-Apr-2003	08:00:00	5.47
20-Apr-2003	08:00:00	11.1
21-Apr-2003	08:00:00	16.27
22-Apr-2003	08:00:00	19.95
23-Apr-2003	08:00:00	21.48
24-Apr-2003	08:00:00	22.07
25-Apr-2003	08:00:00	21.52
26-Apr-2003	08:00:00	Out of Range
27-Apr-2003	08:00:00	19.21
28-Apr-2003	08:00:00	18.23
29-Apr-2003	08:00:00	18.97
30-Apr-2003	08:00:00	18.54
01-May-2003	08:00:00	16.47
02-May-2003	08:00:00	13.45
03-May-2003	08:00:00	10.09

04-May-2003	08:00:00	6.8
05-May-2003	08:00:00	2.76
06-May-2003	08:00:00	Out of Range
07-May-2003	08:00:00	Out of Range
08-May-2003	08:00:00	Out of Range
09-May-2003	08:00:00	0.02
10-May-2003	08:00:00	-0.29
11-May-2003	08:00:00	-0.8
12-May-2003	08:00:00	-2.4
13-May-2003	08:00:00	-6.08
14-May-2003	08:00:00	-10.08
15-May-2003	08:00:00	-13.48
16-May-2003	08:00:00	-14.54
17-May-2003	08:00:00	-16.07
18-May-2003	08:00:00	-17.13
19-May-2003	08:00:00	-2.13
20-May-2003	08:00:00	-6.59
21-May-2003	08:00:00	-9.37
22-May-2003	08:00:00	Out of Range
23-May-2003	08:00:00	Out of Range
24-May-2003	08:00:00	Out of Range
25-May-2003	08:00:00	Out of Range
26-May-2003	08:00:00	Out of Range
27-May-2003	08:00:00	Out of Range
28-May-2003	08:00:00	Out of Range
29-May-2003	08:00:00	Out of Range
30-May-2003	08:00:00	Out of Range
31-May-2003	08:00:00	Out of Range
01-Jun-2003	08:00:00	Out of Range
02-Jun-2003	08:00:00	Out of Range

Howell Woods 2003
Infinity Well 1 REF N3B6A9F1 riser ht 3.32

Day	time	reading	corrected
01-Jan-2003	08:00:00	0.96	4.28
02-Jan-2003	08:00:00	0.46	3.78
03-Jan-2003	08:00:00	0.3	3.62
04-Jan-2003	08:00:00	0.06	3.38
05-Jan-2003	08:00:00	-0.25	3.07
06-Jan-2003	08:00:00	-0.41	2.91
07-Jan-2003	08:00:00	-0.68	2.64
08-Jan-2003	08:00:00	-0.88	2.44
09-Jan-2003	08:00:00	-1.07	2.25
10-Jan-2003	08:00:00	-1.27	2.05
11-Jan-2003	08:00:00	-1.82	1.5
12-Jan-2003	08:00:00	-2.56	0.76
13-Jan-2003	08:00:00	-2.83	0.49
14-Jan-2003	08:00:00	-3.07	0.25
15-Jan-2003	08:00:00	-3.38	-0.06
16-Jan-2003	08:00:00	-4.13	-0.81
17-Jan-2003	08:00:00	-2.09	1.23
18-Jan-2003	08:00:00	-3.54	-0.22
19-Jan-2003	08:00:00	-4.13	-0.81
20-Jan-2003	08:00:00	-3.89	-0.57
21-Jan-2003	08:00:00	-3.97	-0.65
22-Jan-2003	08:00:00	-4.4	-1.08
23-Jan-2003	08:00:00	-4.63	-1.31
24-Jan-2003	08:00:00	-5.38	-2.06
25-Jan-2003	08:00:00	-5.38	-2.06
26-Jan-2003	08:00:00	-4.56	-1.24
27-Jan-2003	08:00:00	-4.87	-1.55
28-Jan-2003	08:00:00	-5.81	-2.49
29-Jan-2003	08:00:00	-4.99	-1.67
30-Jan-2003	08:00:00	-3.03	0.29
31-Jan-2003	08:00:00	-0.99	2.33
01-Feb-2003	08:00:00	-1.89	1.43
02-Feb-2003	08:00:00	-2.79	0.53
03-Feb-2003	08:00:00	-3.26	0.06
04-Feb-2003	08:00:00	-3.38	-0.06
05-Feb-2003	08:00:00	-3.66	-0.34
06-Feb-2003	08:00:00	-4.13	-0.81
07-Feb-2003	08:00:00	-0.01	3.31
08-Feb-2003	08:00:00	-0.45	2.87
09-Feb-2003	08:00:00	-0.48	2.84
10-Feb-2003	08:00:00	0.02	3.34
11-Feb-2003	08:00:00	0.1	3.42
12-Feb-2003	08:00:00	0.02	3.34
13-Feb-2003	08:00:00	-0.29	3.03
14-Feb-2003	08:00:00	-0.33	2.99
15-Feb-2003	08:00:00	-0.05	3.27
16-Feb-2003	08:00:00	-0.25	3.07
17-Feb-2003	08:00:00	0.77	4.09
18-Feb-2003	08:00:00	0.42	3.74
19-Feb-2003	08:00:00	0.18	3.5
20-Feb-2003	08:00:00	0.18	3.5
21-Feb-2003	08:00:00	0.34	3.66
22-Feb-2003	08:00:00	0.14	3.46
23-Feb-2003	08:00:00	0.53	3.85
24-Feb-2003	08:00:00	0.18	3.5
25-Feb-2003	08:00:00	-0.01	3.31
26-Feb-2003	08:00:00	2.02	5.34
27-Feb-2003	08:00:00	3.04	6.36
28-Feb-2003	08:00:00	5.51	8.83

01-Mar-2003	08:00:00	5.43	8.75
02-Mar-2003	08:00:00	17.33	20.65
03-Mar-2003	08:00:00	18.03	21.35
04-Mar-2003	08:00:00	16.12	19.44
05-Mar-2003	08:00:00	14.08	17.4
06-Mar-2003	08:00:00	13.57	16.89
07-Mar-2003	08:00:00	15.33	18.65
08-Mar-2003	08:00:00	23.67	26.99
09-Mar-2003	08:00:00	23.32	26.64
10-Mar-2003	08:00:00	16.78	20.1
11-Mar-2003	08:00:00	9.97	13.29
12-Mar-2003	08:00:00	5.94	9.26
13-Mar-2003	08:00:00	3.43	6.75
14-Mar-2003	08:00:00	1.9	5.22
15-Mar-2003	08:00:00	1.04	4.36
16-Mar-2003	08:00:00	3.78	7.1
17-Mar-2003	08:00:00	8.87	12.19
18-Mar-2003	08:00:00	11.54	14.86
19-Mar-2003	08:00:00	11.54	14.86
20-Mar-2003	08:00:00	12.2	15.52
21-Mar-2003	08:00:00	19.68	23
22-Mar-2003	08:00:00	Out of Range	#VALUE!
23-Mar-2003	08:00:00	Out of Range	#VALUE!
24-Mar-2003	08:00:00	Out of Range	#VALUE!
25-Mar-2003	08:00:00	16.31	19.63
26-Mar-2003	08:00:00	9.26	12.58
27-Mar-2003	08:00:00	5.47	8.79
28-Mar-2003	08:00:00	2.88	6.2
29-Mar-2003	08:00:00	1.55	4.87
30-Mar-2003	08:00:00	1.2	4.52
31-Mar-2003	08:00:00	1.67	4.99
01-Apr-2003	08:00:00	5.04	8.36
02-Apr-2003	08:00:00	6.88	10.2
03-Apr-2003	08:00:00	5.31	8.63
04-Apr-2003	08:00:00	5.7	9.02
05-Apr-2003	08:00:00	7.54	10.86
06-Apr-2003	08:00:00	8.05	11.37
07-Apr-2003	08:00:00	7.89	11.21
08-Apr-2003	08:00:00	9.42	12.74
09-Apr-2003	08:00:00	13.14	16.46
10-Apr-2003	08:00:00	14.9	18.22
11-Apr-2003	08:00:00	20.66	23.98
12-Apr-2003	08:00:00	Out of Range	#VALUE!
13-Apr-2003	08:00:00	Out of Range	#VALUE!
14-Apr-2003	08:00:00	Out of Range	#VALUE!
15-Apr-2003	08:00:00	23.87	27.19
16-Apr-2003	08:00:00	16.66	19.98
17-Apr-2003	08:00:00	12.04	15.36
18-Apr-2003	08:00:00	8.95	12.27
19-Apr-2003	08:00:00	8.83	12.15
20-Apr-2003	08:00:00	14	17.32
21-Apr-2003	08:00:00	19.21	22.53
22-Apr-2003	08:00:00	22.77	26.09
23-Apr-2003	08:00:00	23.87	27.19
24-Apr-2003	08:00:00	Out of Range	#VALUE!
25-Apr-2003	08:00:00	24.03	27.35
26-Apr-2003	08:00:00	23.75	27.07
27-Apr-2003	08:00:00	22.46	25.78
28-Apr-2003	08:00:00	21.25	24.57
29-Apr-2003	08:00:00	21.83	25.15
30-Apr-2003	08:00:00	21.48	24.8
01-May-2003	08:00:00	19.56	22.88
02-May-2003	08:00:00	17.37	20.69
03-May-2003	08:00:00	14.39	17.71

04-May-2003	08:00:00	11.61	14.93
05-May-2003	08:00:00	8.52	11.84
06-May-2003	08:00:00	6.88	10.2
07-May-2003	08:00:00	4.76	8.08
08-May-2003	08:00:00	2.84	6.16
09-May-2003	08:00:00	1.28	4.6
10-May-2003	08:00:00	0.92	4.24
11-May-2003	08:00:00	0.69	4.01
12-May-2003	08:00:00	0.14	3.46
13-May-2003	08:00:00	-0.6	2.72
14-May-2003	08:00:00	-1.74	1.58
15-May-2003	08:00:00	-2.44	0.88
16-May-2003	08:00:00	-2.48	0.84
17-May-2003	08:00:00	-3.38	-0.06
18-May-2003	08:00:00	-3.97	-0.65
19-May-2003	08:00:00	0.1	3.42
20-May-2003	08:00:00	-0.52	2.8
21-May-2003	08:00:00	-1.86	1.46
22-May-2003	08:00:00	-1.15	2.17
23-May-2003	08:00:00	0.57	3.89
24-May-2003	08:00:00	0.38	3.7
25-May-2003	08:00:00	0.14	3.46
26-May-2003	08:00:00	3.2	6.52
27-May-2003	08:00:00	4.84	8.16
28-May-2003	08:00:00	4.14	7.46
29-May-2003	08:00:00	2.45	5.77
30-May-2003	08:00:00	1.12	4.44
31-May-2003	08:00:00	0.61	3.93
01-Jun-2003	08:00:00	1.63	4.95
02-Jun-2003	08:00:00	4.8	8.12

Howell Woods 2003
Infinity Well 2 REF N3B6AA64 riser ht 3.33

Date	time	reading	corrected
01-Jan-2003	08:00:00	2.33	5.66
02-Jan-2003	08:00:00	1.55	4.88
03-Jan-2003	08:00:00	0.81	4.14
04-Jan-2003	08:00:00	0.61	3.94
05-Jan-2003	08:00:00	-0.17	3.16
06-Jan-2003	08:00:00	-0.99	2.34
07-Jan-2003	08:00:00	-1.39	1.94
08-Jan-2003	08:00:00	-1.58	1.75
09-Jan-2003	08:00:00	-1.78	1.55
10-Jan-2003	08:00:00	-1.97	1.36
11-Jan-2003	08:00:00	-2.52	0.81
12-Jan-2003	08:00:00	-3.11	0.22
13-Jan-2003	08:00:00	-3.23	0.1
14-Jan-2003	08:00:00	-3.26	0.07
15-Jan-2003	08:00:00	-3.46	-0.13
16-Jan-2003	08:00:00	-4.44	-1.11
17-Jan-2003	08:00:00	-2.32	1.01
18-Jan-2003	08:00:00	-3.5	-0.17
19-Jan-2003	08:00:00	-3.58	-0.25
20-Jan-2003	08:00:00	-3.3	0.03
21-Jan-2003	08:00:00	-3.46	-0.13
22-Jan-2003	08:00:00	-3.73	-0.4
23-Jan-2003	08:00:00	-3.77	-0.44
24-Jan-2003	08:00:00	-3.73	-0.4
25-Jan-2003	08:00:00	-3.58	-0.25
26-Jan-2003	08:00:00	-3.81	-0.48
27-Jan-2003	08:00:00	-3.93	-0.6
28-Jan-2003	08:00:00	-3.97	-0.64
29-Jan-2003	08:00:00	-3.62	-0.29
30-Jan-2003	08:00:00	-2.83	0.5
31-Jan-2003	08:00:00	-1.54	1.79
01-Feb-2003	08:00:00	-2.13	1.2
02-Feb-2003	08:00:00	-2.6	0.73
03-Feb-2003	08:00:00	-2.87	0.46
04-Feb-2003	08:00:00	-2.68	0.65
05-Feb-2003	08:00:00	-3.26	0.07
06-Feb-2003	08:00:00	-3.54	-0.21
07-Feb-2003	08:00:00	-0.68	2.65
08-Feb-2003	08:00:00	-1.46	1.87
09-Feb-2003	08:00:00	-1.31	2.02
10-Feb-2003	08:00:00	-0.6	2.73
11-Feb-2003	08:00:00	1.36	4.69
12-Feb-2003	08:00:00	1.2	4.53
13-Feb-2003	08:00:00	0.3	3.63
14-Feb-2003	08:00:00	-0.29	3.04
15-Feb-2003	08:00:00	-0.45	2.88
16-Feb-2003	08:00:00	-1.15	2.18
17-Feb-2003	08:00:00	1.24	4.57
18-Feb-2003	08:00:00	1	4.33
19-Feb-2003	08:00:00	1.04	4.37
20-Feb-2003	08:00:00	0.61	3.94
21-Feb-2003	08:00:00	-0.09	3.24
22-Feb-2003	08:00:00	-0.68	2.65
23-Feb-2003	08:00:00	-0.37	2.96
24-Feb-2003	08:00:00	-0.99	2.34
25-Feb-2003	08:00:00	-1.03	2.3
26-Feb-2003	08:00:00	3.7	7.03
27-Feb-2003	08:00:00	4.64	7.97
28-Feb-2003	08:00:00	6.99	10.32

01-Mar-2003	08:00:00	6.88	10.21
02-Mar-2003	08:00:00	18.7	22.03
03-Mar-2003	08:00:00	19.37	22.7
04-Mar-2003	08:00:00	17.53	20.86
05-Mar-2003	08:00:00	15.45	18.78
06-Mar-2003	08:00:00	14.9	18.23
07-Mar-2003	08:00:00	16.74	20.07
08-Mar-2003	08:00:00	Out of Range	#VALUE!
09-Mar-2003	08:00:00	Out of Range	#VALUE!
10-Mar-2003	08:00:00	18.11	21.44
11-Mar-2003	08:00:00	11.69	15.02
12-Mar-2003	08:00:00	7.54	10.87
13-Mar-2003	08:00:00	4.96	8.29
14-Mar-2003	08:00:00	3.59	6.92
15-Mar-2003	08:00:00	2.33	5.66
16-Mar-2003	08:00:00	5.54	8.87
17-Mar-2003	08:00:00	9.81	13.14
18-Mar-2003	08:00:00	13.06	16.39
19-Mar-2003	08:00:00	13.06	16.39
20-Mar-2003	08:00:00	13.61	16.94
21-Mar-2003	08:00:00	21.32	24.65
22-Mar-2003	08:00:00	Out of Range	#VALUE!
23-Mar-2003	08:00:00	Out of Range	#VALUE!
24-Mar-2003	08:00:00	Out of Range	#VALUE!
25-Mar-2003	08:00:00	17.68	21.01
26-Mar-2003	08:00:00	10.36	13.69
27-Mar-2003	08:00:00	6.92	10.25
28-Mar-2003	08:00:00	4.41	7.74
29-Mar-2003	08:00:00	2.61	5.94
30-Mar-2003	08:00:00	2.37	5.7
31-Mar-2003	08:00:00	3.39	6.72
01-Apr-2003	08:00:00	6.6	9.93
02-Apr-2003	08:00:00	8.52	11.85
03-Apr-2003	08:00:00	6.95	10.28
04-Apr-2003	08:00:00	7.39	10.72
05-Apr-2003	08:00:00	9.15	12.48
06-Apr-2003	08:00:00	9.46	12.79
07-Apr-2003	08:00:00	9.3	12.63
08-Apr-2003	08:00:00	10.6	13.93
09-Apr-2003	08:00:00	14.75	18.08
10-Apr-2003	08:00:00	16.43	19.76
11-Apr-2003	08:00:00	22.15	25.48
12-Apr-2003	08:00:00	Out of Range	#VALUE!
13-Apr-2003	08:00:00	Out of Range	#VALUE!
14-Apr-2003	08:00:00	Out of Range	#VALUE!
15-Apr-2003	08:00:00	Out of Range	#VALUE!
16-Apr-2003	08:00:00	18.23	21.56
17-Apr-2003	08:00:00	13.57	16.9
18-Apr-2003	08:00:00	10.13	13.46
19-Apr-2003	08:00:00	10.01	13.34
20-Apr-2003	08:00:00	15.29	18.62
21-Apr-2003	08:00:00	20.66	23.99
22-Apr-2003	08:00:00	23.95	27.28
23-Apr-2003	08:00:00	Out of Range	#VALUE!
24-Apr-2003	08:00:00	Out of Range	#VALUE!
25-Apr-2003	08:00:00	Out of Range	#VALUE!
26-Apr-2003	08:00:00	Out of Range	#VALUE!
27-Apr-2003	08:00:00	23.99	27.32
28-Apr-2003	08:00:00	22.89	26.22
29-Apr-2003	08:00:00	23.44	26.77
30-Apr-2003	08:00:00	22.97	26.3
01-May-2003	08:00:00	21.28	24.61
02-May-2003	08:00:00	18.9	22.23
03-May-2003	08:00:00	16.08	19.41

04-May-2003	08:00:00	13.45	16.78
05-May-2003	08:00:00	9.73	13.06
06-May-2003	08:00:00	8.52	11.85
07-May-2003	08:00:00	6.45	9.78
08-May-2003	08:00:00	4.64	7.97
09-May-2003	08:00:00	2.26	5.59
10-May-2003	08:00:00	0.89	4.22
11-May-2003	08:00:00	-0.41	2.92
12-May-2003	08:00:00	-1.07	2.26
13-May-2003	08:00:00	-2.09	1.24
14-May-2003	08:00:00	-3.11	0.22
15-May-2003	08:00:00	-4.13	-0.8
16-May-2003	08:00:00	-3.81	-0.48
17-May-2003	08:00:00	-5.1	-1.77
18-May-2003	08:00:00	-5.18	-1.85
19-May-2003	08:00:00	-0.72	2.61
20-May-2003	08:00:00	-1.89	1.44
21-May-2003	08:00:00	-2.95	0.38
22-May-2003	08:00:00	-2.56	0.77
23-May-2003	08:00:00	-0.01	3.32
24-May-2003	08:00:00	-0.56	2.77
25-May-2003	08:00:00	-0.64	2.69
26-May-2003	08:00:00	5	8.33
27-May-2003	08:00:00	6.56	9.89
28-May-2003	08:00:00	5.86	9.19
29-May-2003	08:00:00	4.21	7.54
30-May-2003	08:00:00	2.88	6.21
31-May-2003	08:00:00	1.32	4.65
01-Jun-2003	08:00:00	3.43	6.76
02-Jun-2003	08:00:00	6.56	9.89

Howell Woods 2003
Rain Gauge

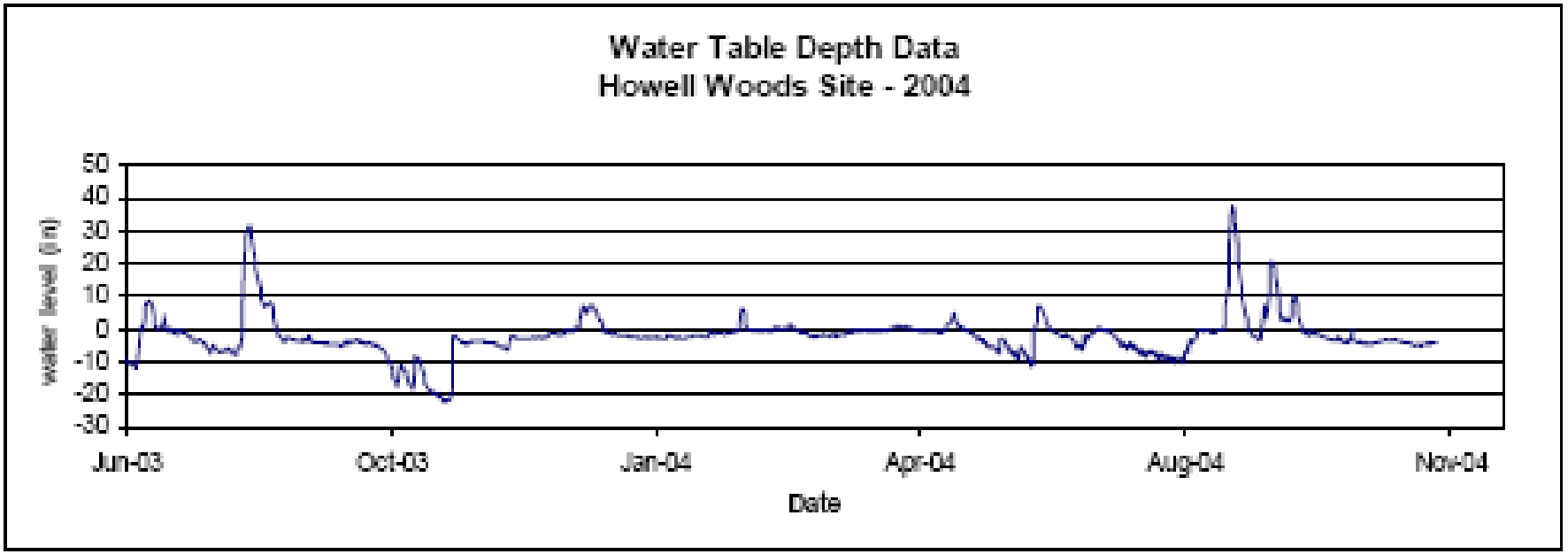
date	time	reading
01-Jan-2003	22:00:00	0.45
02-Jan-2003	22:00:00	0
03-Jan-2003	22:00:00	0.13
04-Jan-2003	22:00:00	0
05-Jan-2003	22:00:00	0.01
06-Jan-2003	22:00:00	0
07-Jan-2003	22:00:00	0
08-Jan-2003	22:00:00	0
09-Jan-2003	22:00:00	0
10-Jan-2003	22:00:00	0
11-Jan-2003	22:00:00	0
12-Jan-2003	22:00:00	0
13-Jan-2003	22:00:00	0.01
14-Jan-2003	22:00:00	0
15-Jan-2003	22:00:00	0
16-Jan-2003	22:00:00	0.08
17-Jan-2003	22:00:00	0.12
18-Jan-2003	22:00:00	0
19-Jan-2003	22:00:00	0
20-Jan-2003	22:00:00	0
21-Jan-2003	22:00:00	0.05
22-Jan-2003	22:00:00	0
23-Jan-2003	22:00:00	0
24-Jan-2003	22:00:00	0
25-Jan-2003	22:00:00	0
26-Jan-2003	22:00:00	0
27-Jan-2003	22:00:00	0
28-Jan-2003	22:00:00	0
29-Jan-2003	22:00:00	0.01
30-Jan-2003	22:00:00	0.44
31-Jan-2003	22:00:00	0.1
01-Feb-2003	22:00:00	0
02-Feb-2003	22:00:00	0
03-Feb-2003	22:00:00	0
04-Feb-2003	22:00:00	0.08
05-Feb-2003	22:00:00	0
06-Feb-2003	22:00:00	0.36
07-Feb-2003	22:00:00	0.64
08-Feb-2003	22:00:00	0
09-Feb-2003	22:00:00	0
10-Feb-2003	22:00:00	0.52
11-Feb-2003	22:00:00	0
12-Feb-2003	22:00:00	0
13-Feb-2003	22:00:00	0
14-Feb-2003	22:00:00	0
15-Feb-2003	22:00:00	0.12
16-Feb-2003	22:00:00	0.9
17-Feb-2003	22:00:00	0.1
18-Feb-2003	22:00:00	0.04
19-Feb-2003	22:00:00	0
20-Feb-2003	22:00:00	0
21-Feb-2003	22:00:00	0
22-Feb-2003	22:00:00	0.36
23-Feb-2003	22:00:00	0.01
24-Feb-2003	22:00:00	0
25-Feb-2003	22:00:00	0
26-Feb-2003	22:00:00	0.1
27-Feb-2003	22:00:00	0.93
28-Feb-2003	22:00:00	0.04

01-Mar-2003	22:00:00	0.09
02-Mar-2003	22:00:00	0.11
03-Mar-2003	22:00:00	0
04-Mar-2003	22:00:00	0
05-Mar-2003	22:00:00	0.14
06-Mar-2003	22:00:00	1.27
07-Mar-2003	22:00:00	0.06
08-Mar-2003	22:00:00	0.01
09-Mar-2003	22:00:00	0
10-Mar-2003	22:00:00	0
11-Mar-2003	22:00:00	0.06
12-Mar-2003	22:00:00	0
13-Mar-2003	22:00:00	0
14-Mar-2003	22:00:00	0.26
15-Mar-2003	22:00:00	0.09
16-Mar-2003	22:00:00	0.3
17-Mar-2003	22:00:00	0.01
18-Mar-2003	22:00:00	0.04
19-Mar-2003	22:00:00	0.02
20-Mar-2003	22:00:00	2.09
21-Mar-2003	22:00:00	0.07
22-Mar-2003	22:00:00	0.01
23-Mar-2003	22:00:00	0
24-Mar-2003	22:00:00	0
25-Mar-2003	22:00:00	0.01
26-Mar-2003	22:00:00	0
27-Mar-2003	22:00:00	0
28-Mar-2003	22:00:00	0.24
29-Mar-2003	22:00:00	0.64
30-Mar-2003	22:00:00	0.12
31-Mar-2003	22:00:00	0.06
01-Apr-2003	22:00:00	0.03
02-Apr-2003	22:00:00	0
03-Apr-2003	22:00:00	0
04-Apr-2003	22:00:00	0
05-Apr-2003	22:00:00	0.02
06-Apr-2003	22:00:00	0.02
07-Apr-2003	22:00:00	0.81
08-Apr-2003	22:00:00	0.24
09-Apr-2003	22:00:00	1.14
10-Apr-2003	22:00:00	1.03
11-Apr-2003	22:00:00	0.03
12-Apr-2003	22:00:00	14.39
13-Apr-2003	22:00:00	0.05
14-Apr-2003	22:00:00	0
15-Apr-2003	22:00:00	0
16-Apr-2003	22:00:00	0
17-Apr-2003	22:00:00	0.01
18-Apr-2003	22:00:00	0.01
19-Apr-2003	22:00:00	0.01
20-Apr-2003	22:00:00	0.01
21-Apr-2003	22:00:00	0.23
22-Apr-2003	22:00:00	0.01
23-Apr-2003	22:00:00	0
24-Apr-2003	22:00:00	0.01
25-Apr-2003	22:00:00	0.3
26-Apr-2003	22:00:00	0.21
27-Apr-2003	22:00:00	0.01
28-Apr-2003	22:00:00	0.01

gauge malfunction

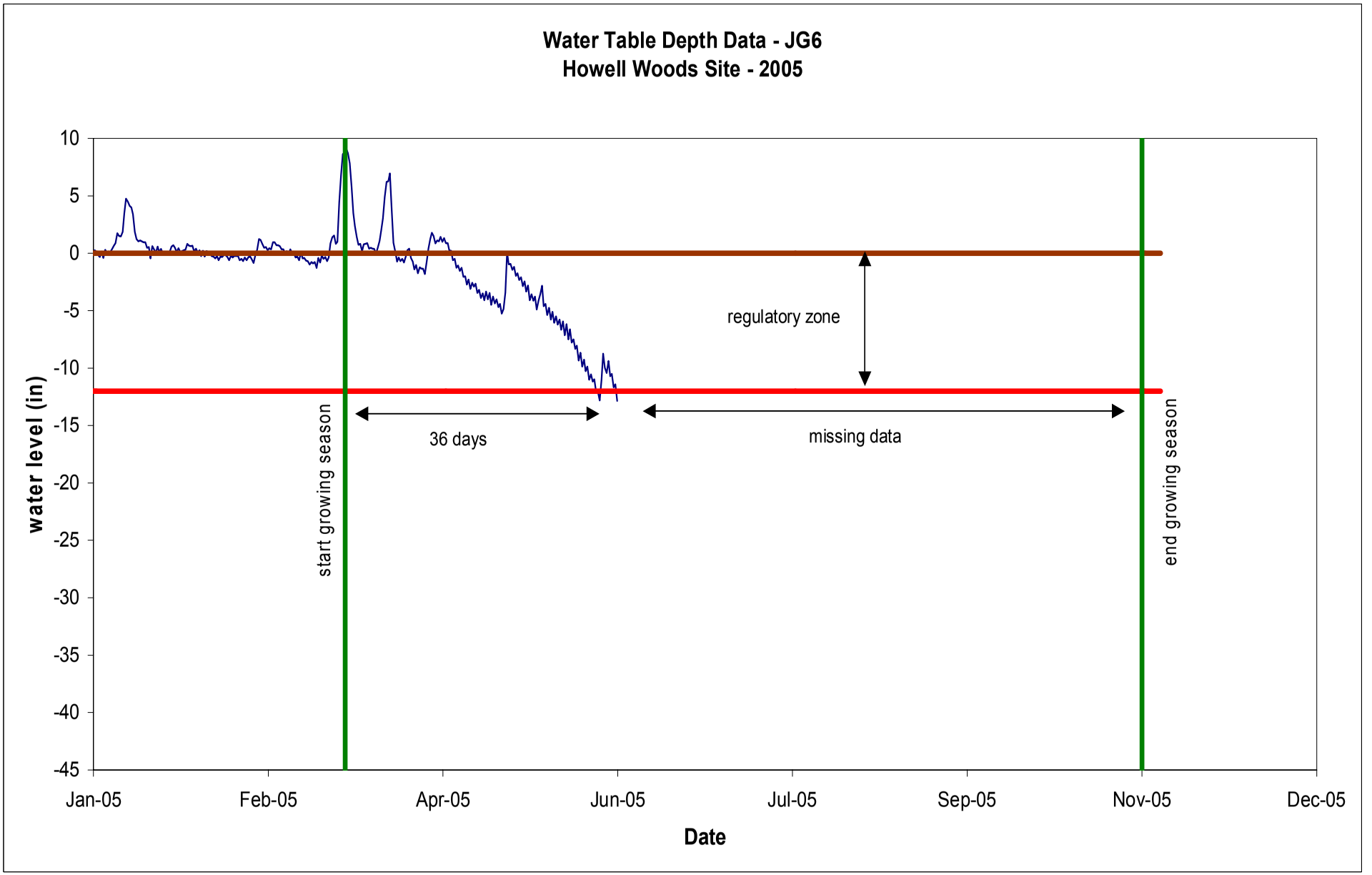
APPENDIX F

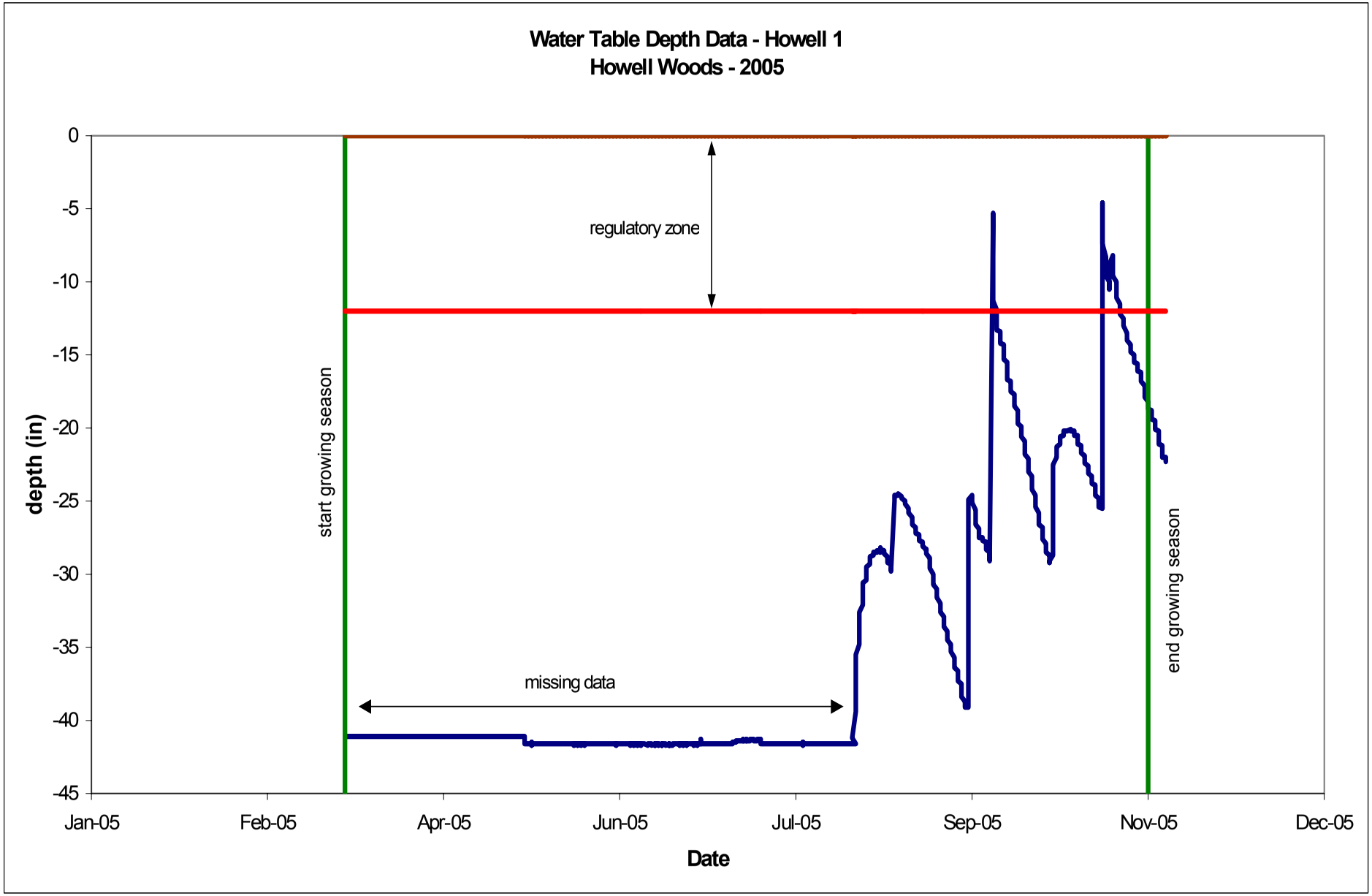
YEAR 3 (2004) GROUNDWATER GAUGE GRAPHS

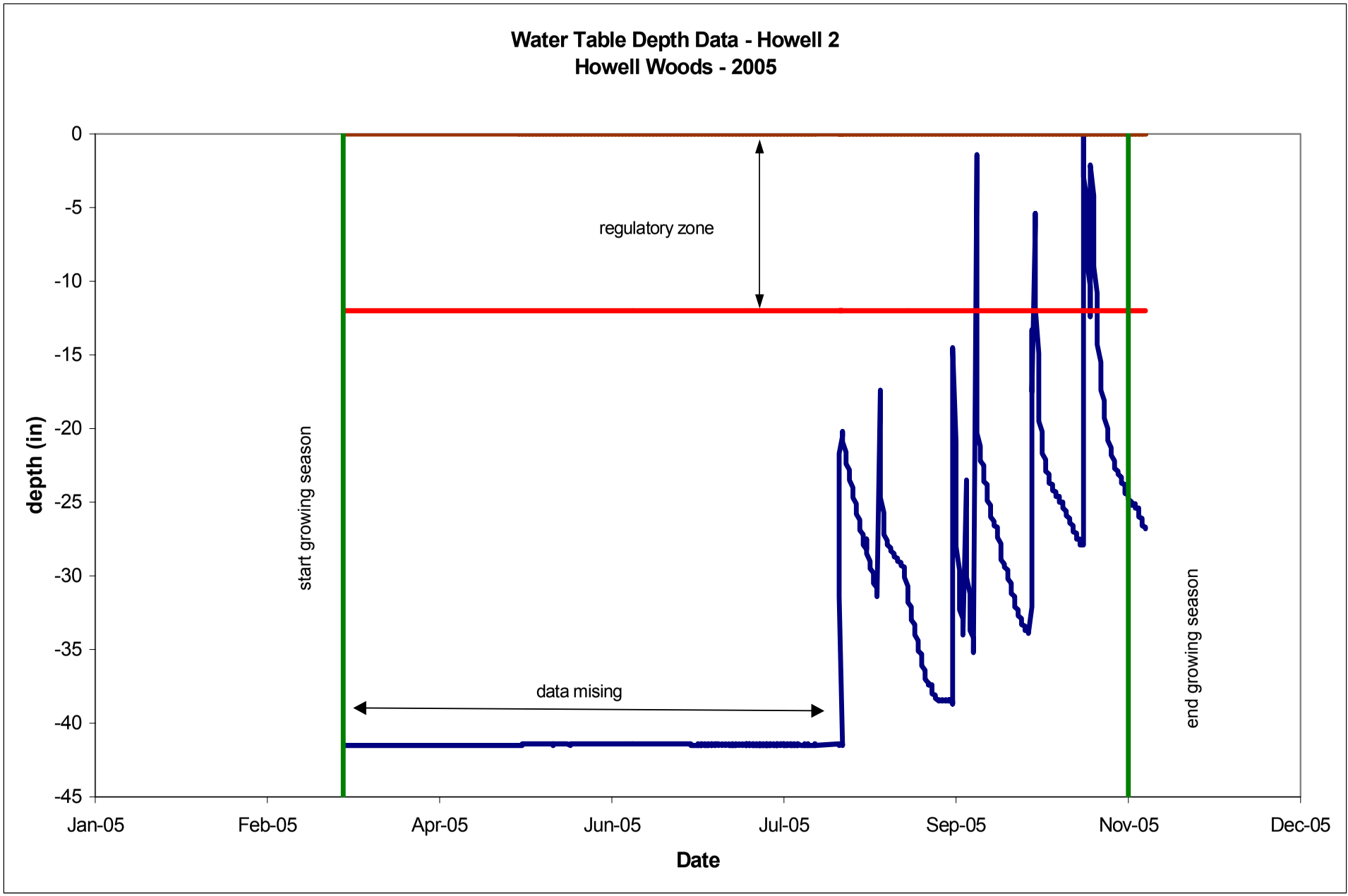

Water Table Depth Data
Howell Woods Site - 2004
water level (in)
50
40
30
20
10
0
-10
-20
-30
Jun-03
Oct-03
Jan-04
Apr-04
Aug-04
Nov-04
Date

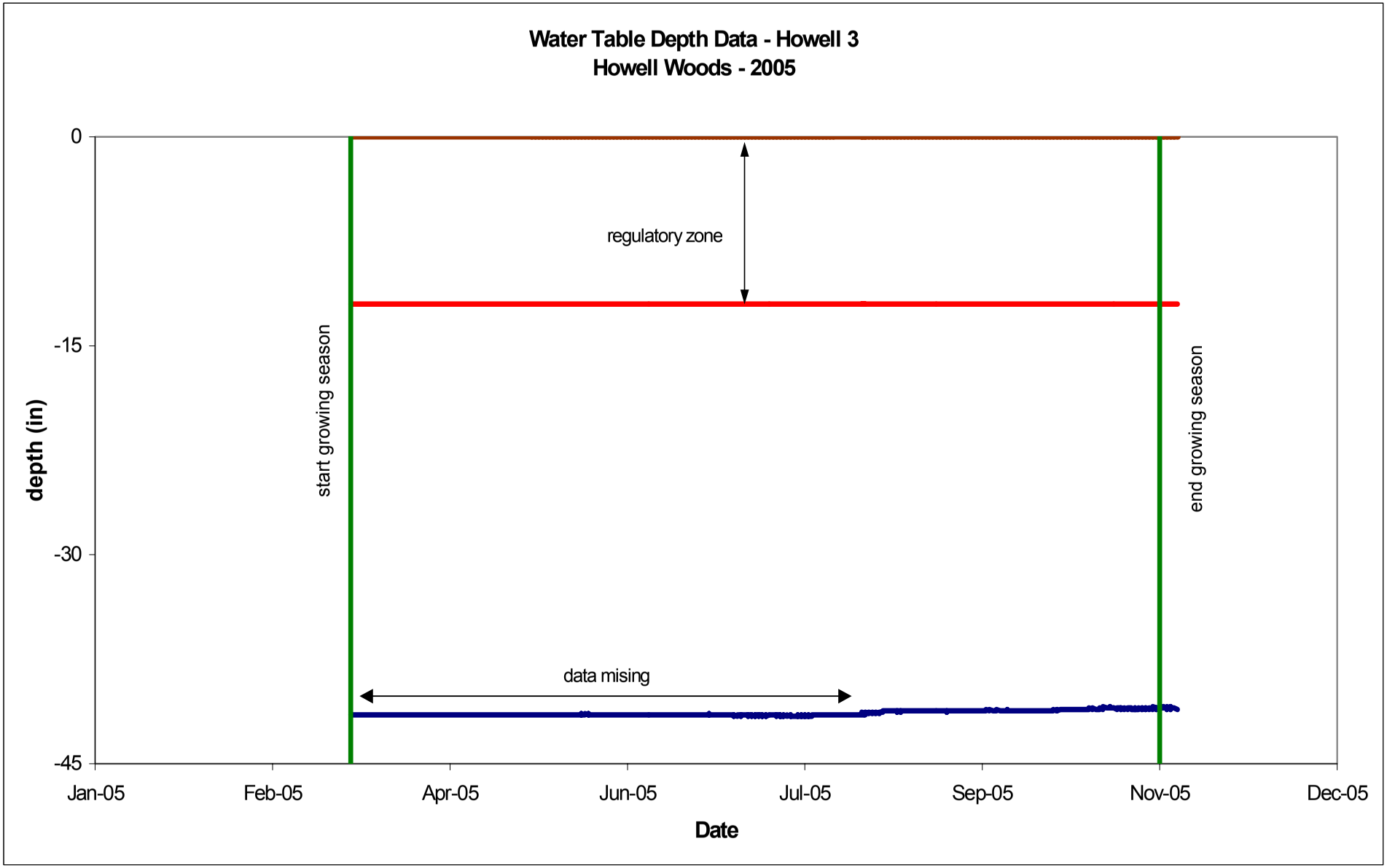
APPENDIX G

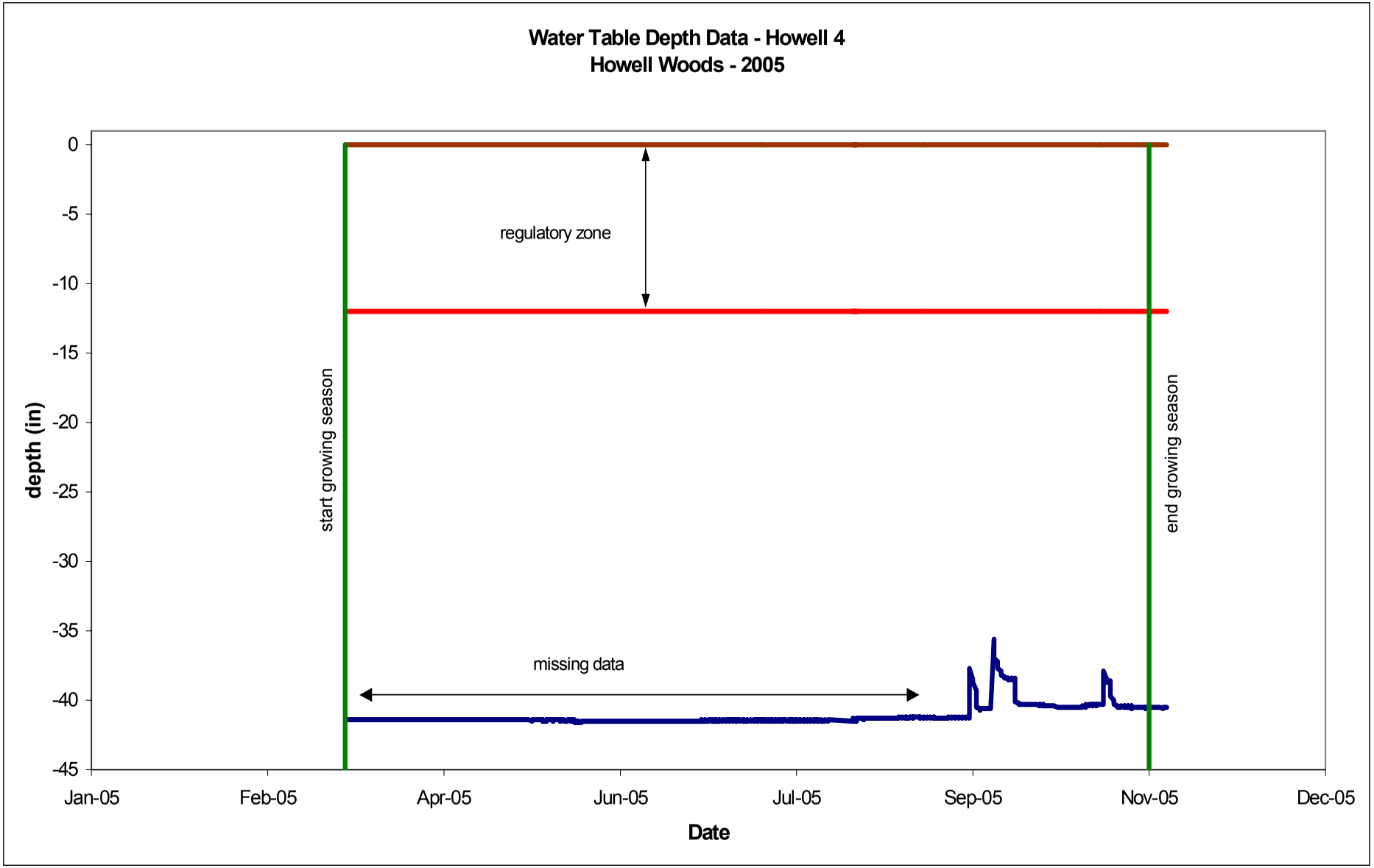
YEAR 4 (2005) GROUNDWATER GAUGE GRAPHS

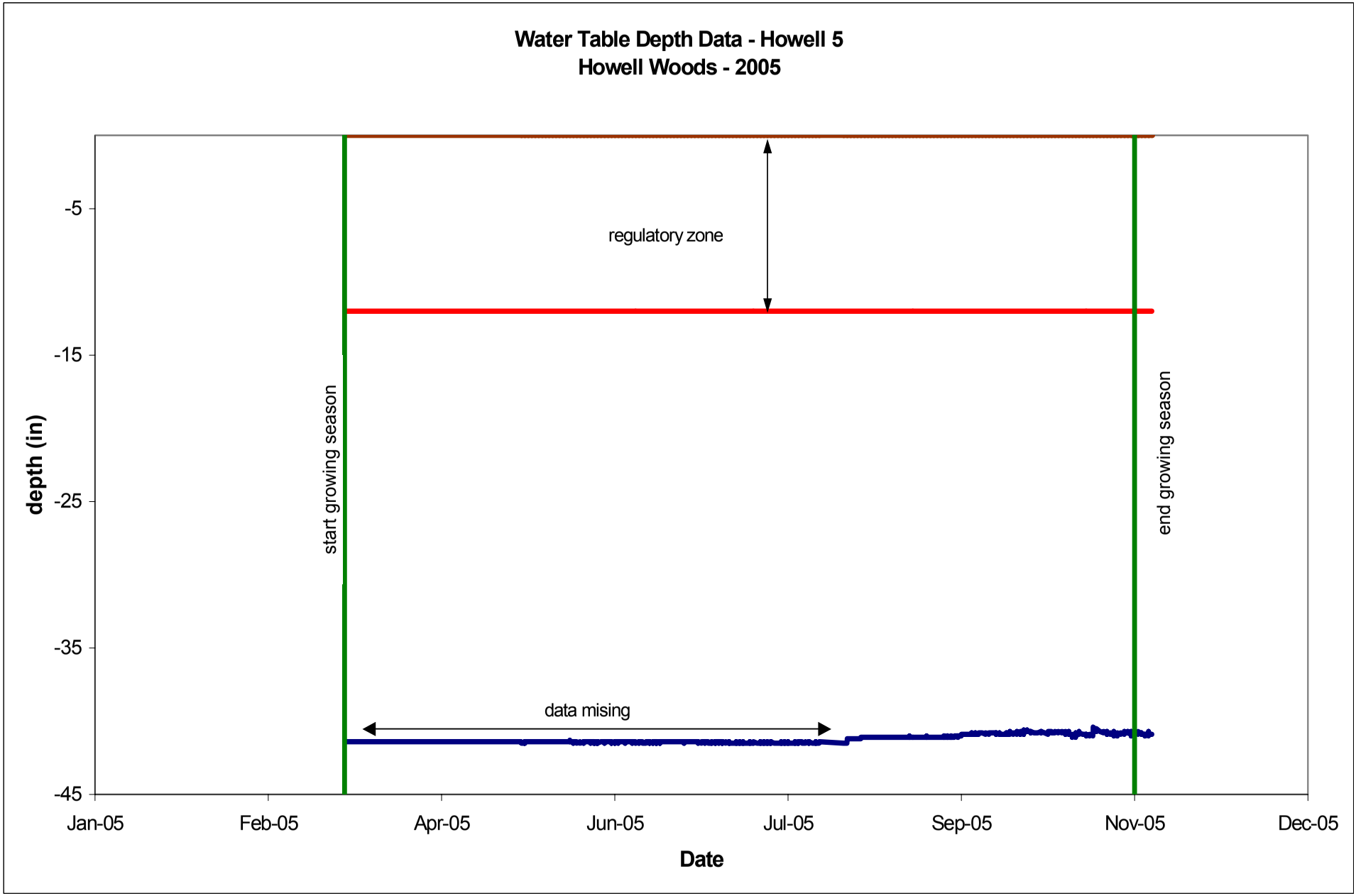

Water Table Depth Data - JG6
Howell Woods Site - 2005
water level (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
Jan-05
Feb-05
Apr-05
Jun-05
Jul-05
Sep-05
Nov-05
Dec-05
Date
regulatory zone
start growing season
36 days
missing data
end growing season


Water Table Depth Data - Howell 1
Howell Woods - 2005
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
depth (in)
regulatory zone
start growing season
end growing season
missing data
Jan-05
Feb-05
Apr-05
Jun-05
Jul-05
Sep-05
Nov-05
Dec-05
Date


Water Table Depth Data - Howell 2
Howell Woods - 2005
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
depth (in)
regulatory zone
start growing season
end growing season
data mising
Jan-05
Feb-05
Apr-05
Jun-05
Jul-05
Sep-05
Nov-05
Dec-05
Date

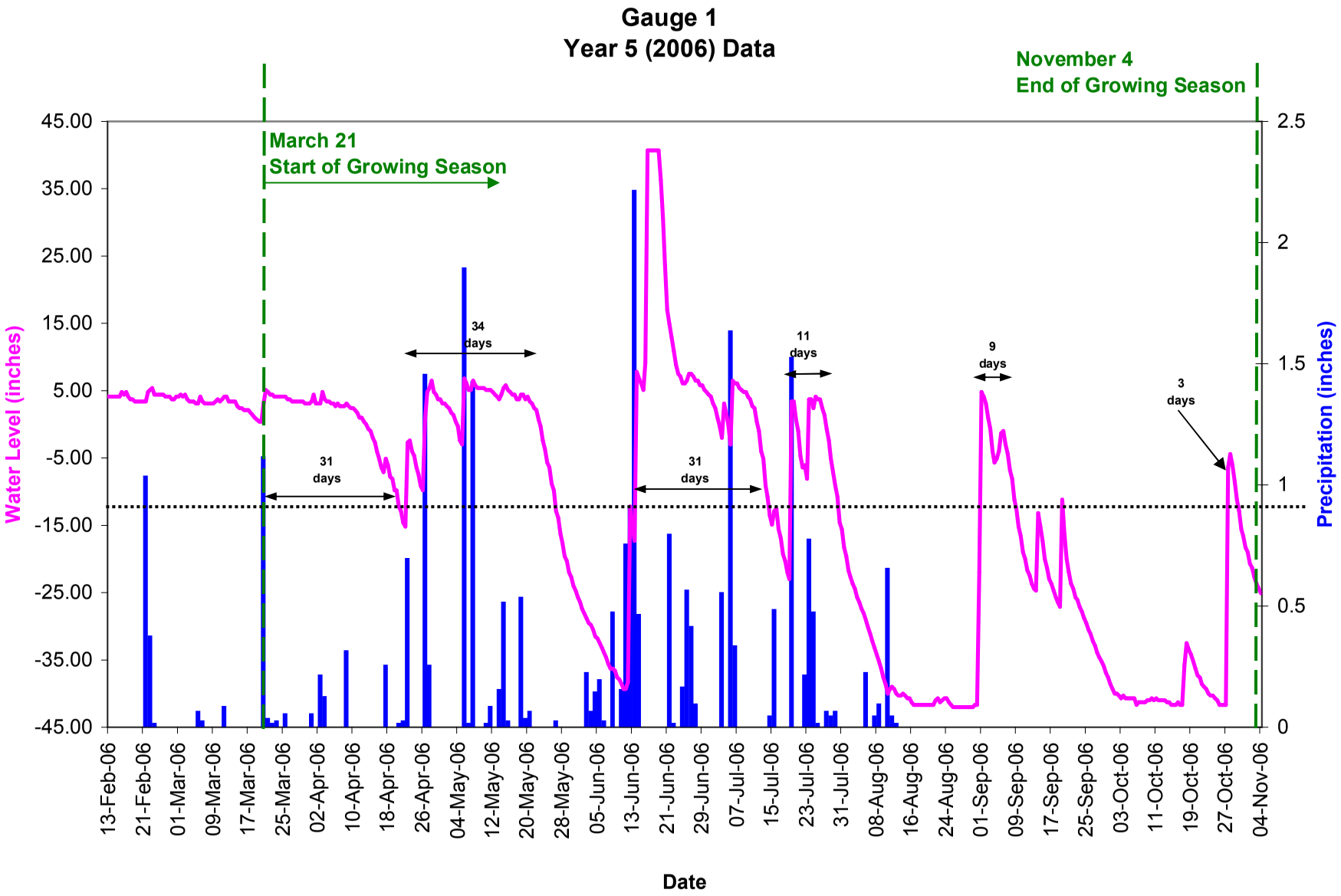

Water Table Depth Data - Howell 3
Howell Woods - 2005
0
-15
-30
-45
depth (in)
regulatory zone
start growing season
end growing season
data mising
Jan-05
Feb-05
Apr-05
Jun-05
Jul-05
Sep-05
Nov-05
Dec-05
Date

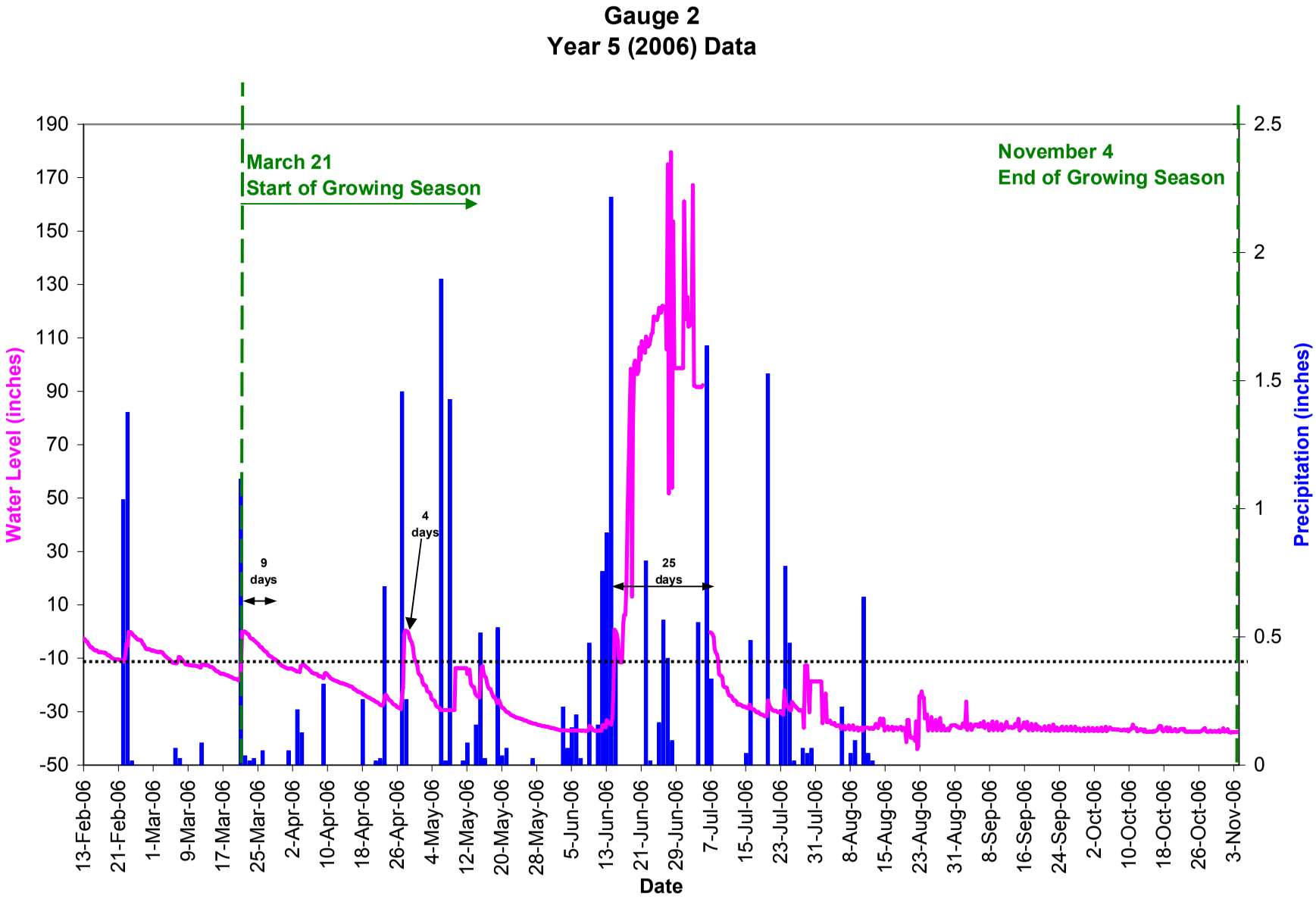

Water Table Depth Data - Howell 4
Howell Woods - 2005
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
depth (in)
regulatory zone
start growing season
end growing season
missing data
Jan-05
Feb-05
Apr-05
Jun-05
Jul-05
Sep-05
Nov-05
Dec-05
Date

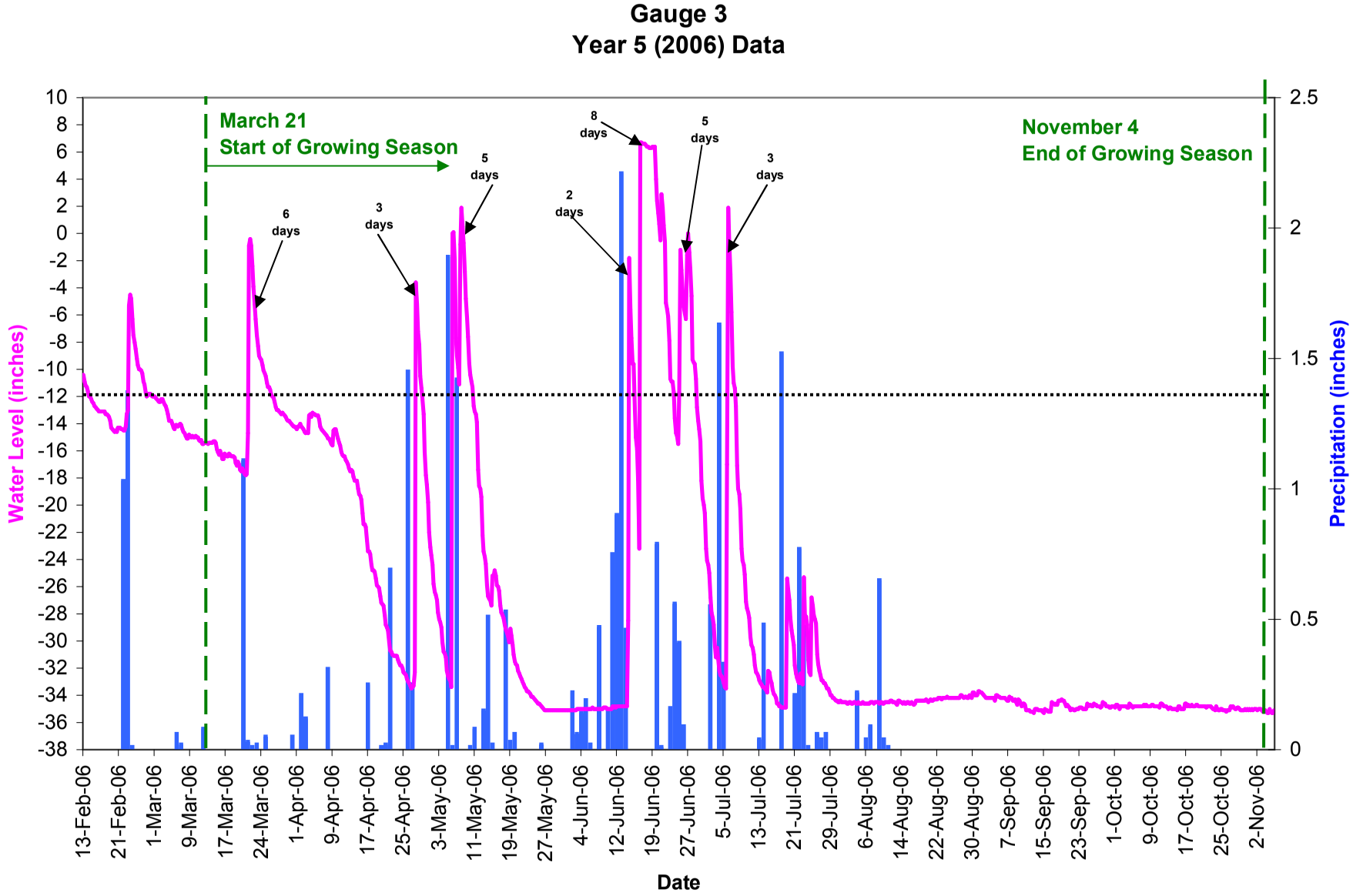

Water Table Depth Data - Howell 5
Howell Woods - 2005
-5
-15
-25
-35
-45
depth (in)
regulatory zone
start growing season
end growing season
data mising
Jan-05
Feb-05
Apr-05
Jun-05
Jul-05
Sep-05
Nov-05
Dec-05
Date

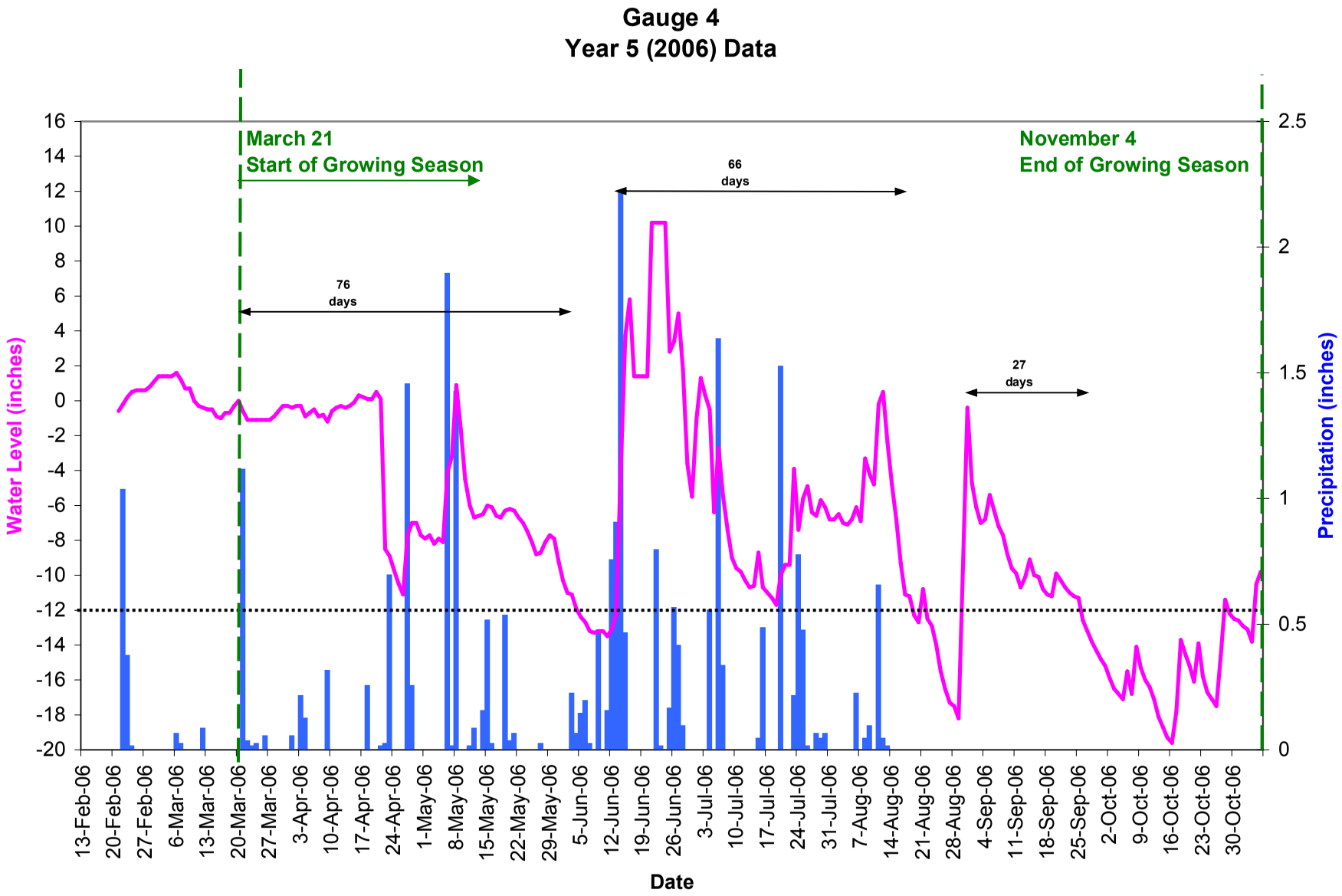
APPENDIX H

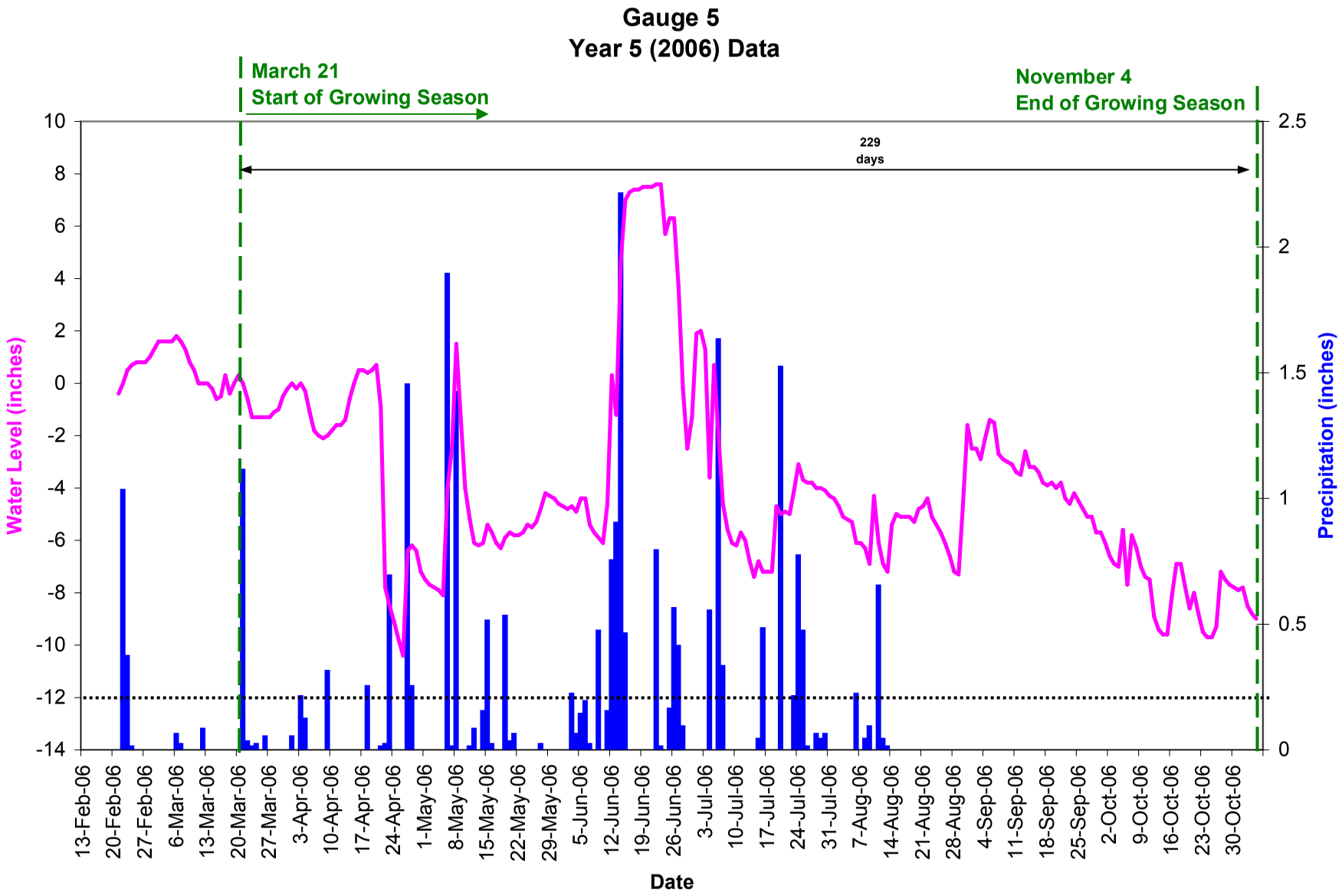
YEAR 5 (2006) GROUNDWATER GAUGE GRAPH

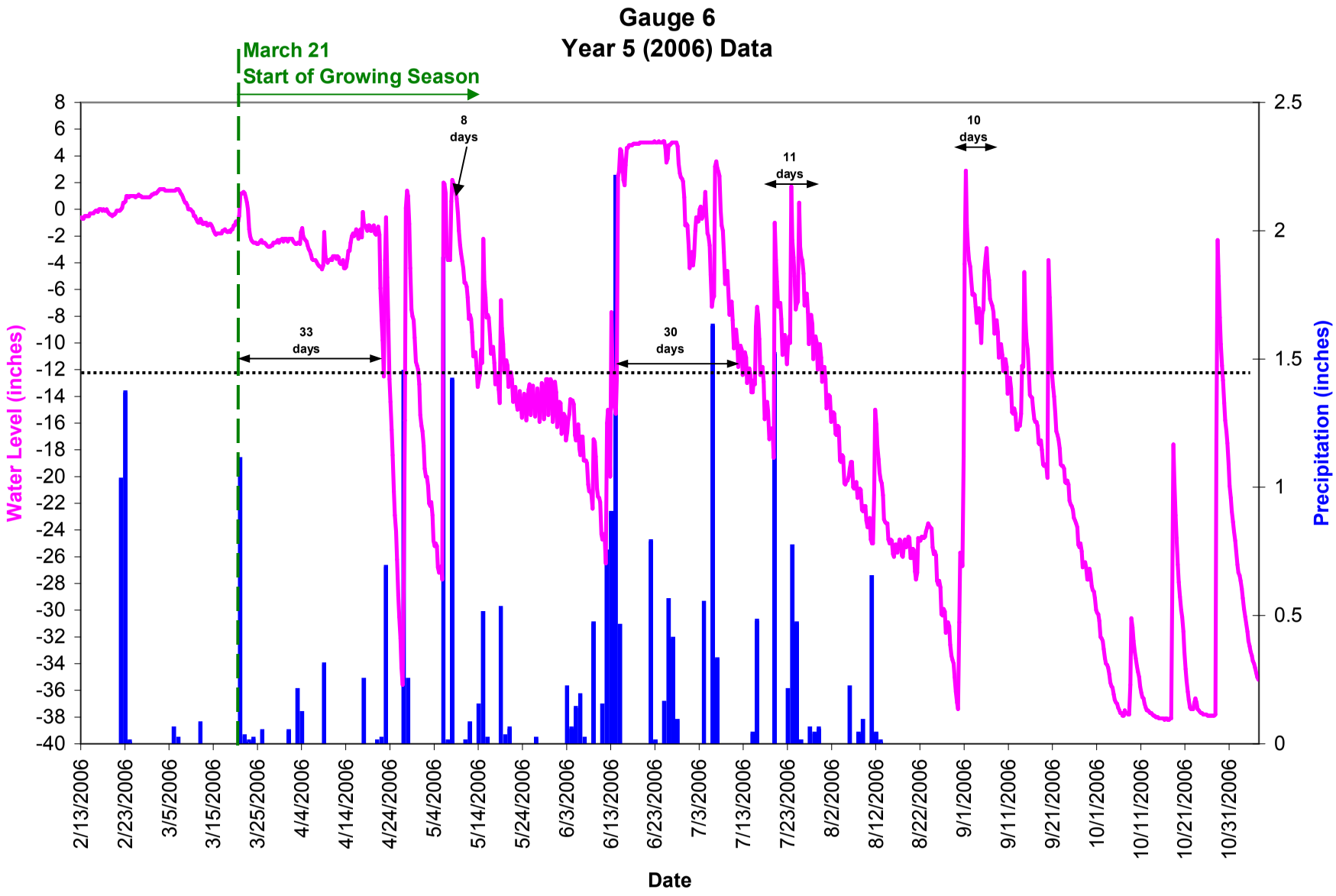

Gauge 1
Year 5 (2006) Data
November 4
End of Growing Season
March 21
Start of Growing Season
34 days
31 days
31 days
11 days
9 days
3 days
Water Level (inches)
Precipitation (inches)
45.00
35.00
25.00
15.00
5.00
-5.00
-15.00
-25.00
-35.00
-45.00
2.5
2
1.5
1
0.5
0
13-Feb-06
21-Feb-06
01-Mar-06
09-Mar-06
17-Mar-06
25-Mar-06
02-Apr-06
10-Apr-06
18-Apr-06
26-Apr-06
04-May-06
12-May-06
20-May-06
28-May-06
05-Jun-06
13-Jun-06
21-Jun-06
29-Jun-06
07-Jul-06
15-Jul-06
23-Jul-06
31-Jul-06
08-Aug-06
16-Aug-06
24-Aug-06
01-Sep-06
09-Sep-06
17-Sep-06
25-Sep-06
03-Oct-06
11-Oct-06
19-Oct-06
27-Oct-06
04-Nov-06
Date

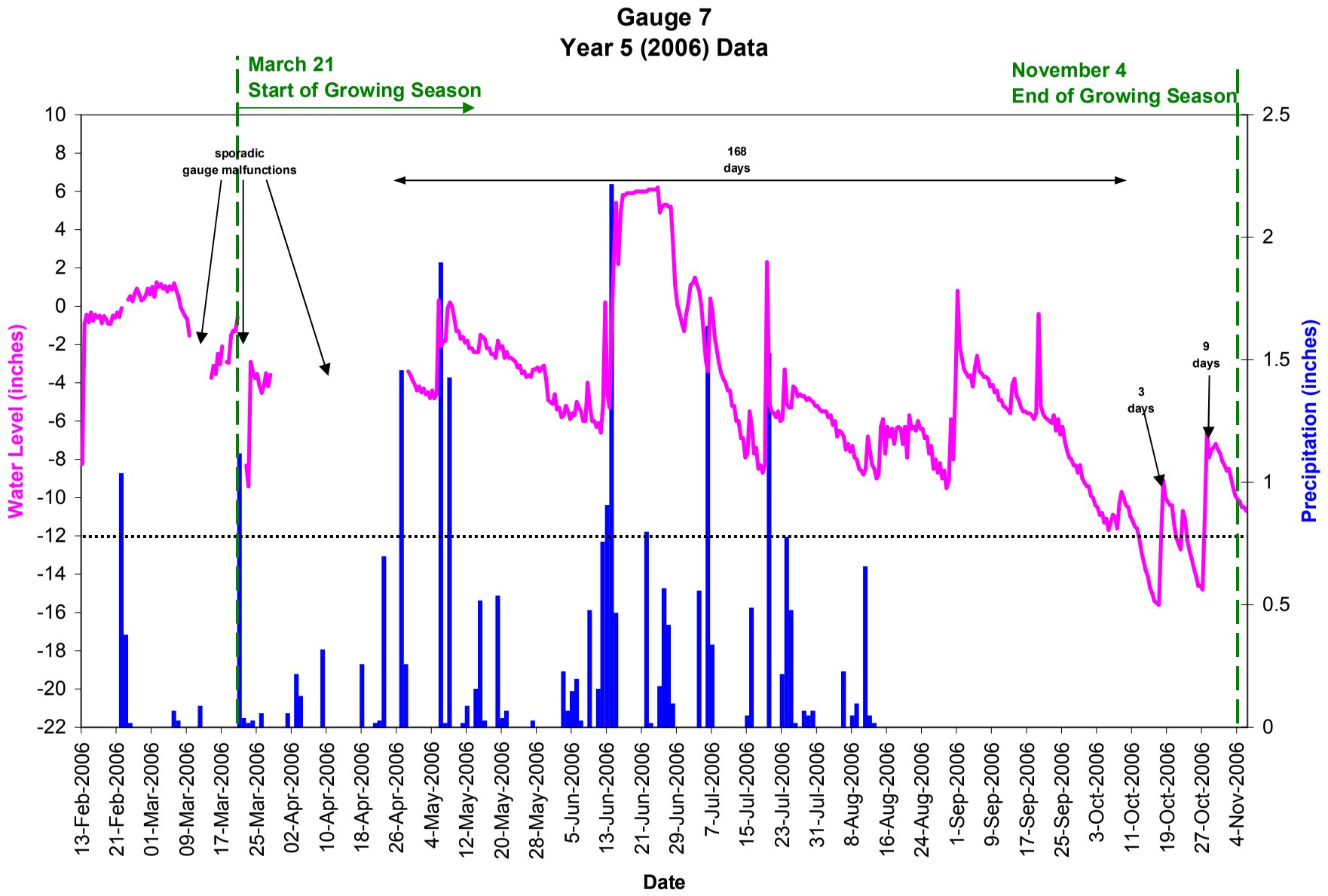

Gauge 2
Year 5 (2006) Data
March 21
Start of Growing Season
November 4
End of Growing Season
9
days
4
days
25
days
Water Level (inches)
Precipitation (inches)
Date
190
170
150
130
110
90
70
50
30
10
-10
-30
-50
2.5
2
1.5
1
0.5
0
13-Feb-06
21-Feb-06
1-Mar-06
9-Mar-06
17-Mar-06
25-Mar-06
2-Apr-06
10-Apr-06
18-Apr-06
26-Apr-06
4-May-06
12-May-06
20-May-06
28-May-06
5-Jun-06
13-Jun-06
21-Jun-06
29-Jun-06
7-Jul-06
15-Jul-06
23-Jul-06
31-Jul-06
8-Aug-06
15-Aug-06
23-Aug-06
31-Aug-06
8-Sep-06
16-Sep-06
24-Sep-06
2-Oct-06
10-Oct-06
18-Oct-06
26-Oct-06
3-Nov-06

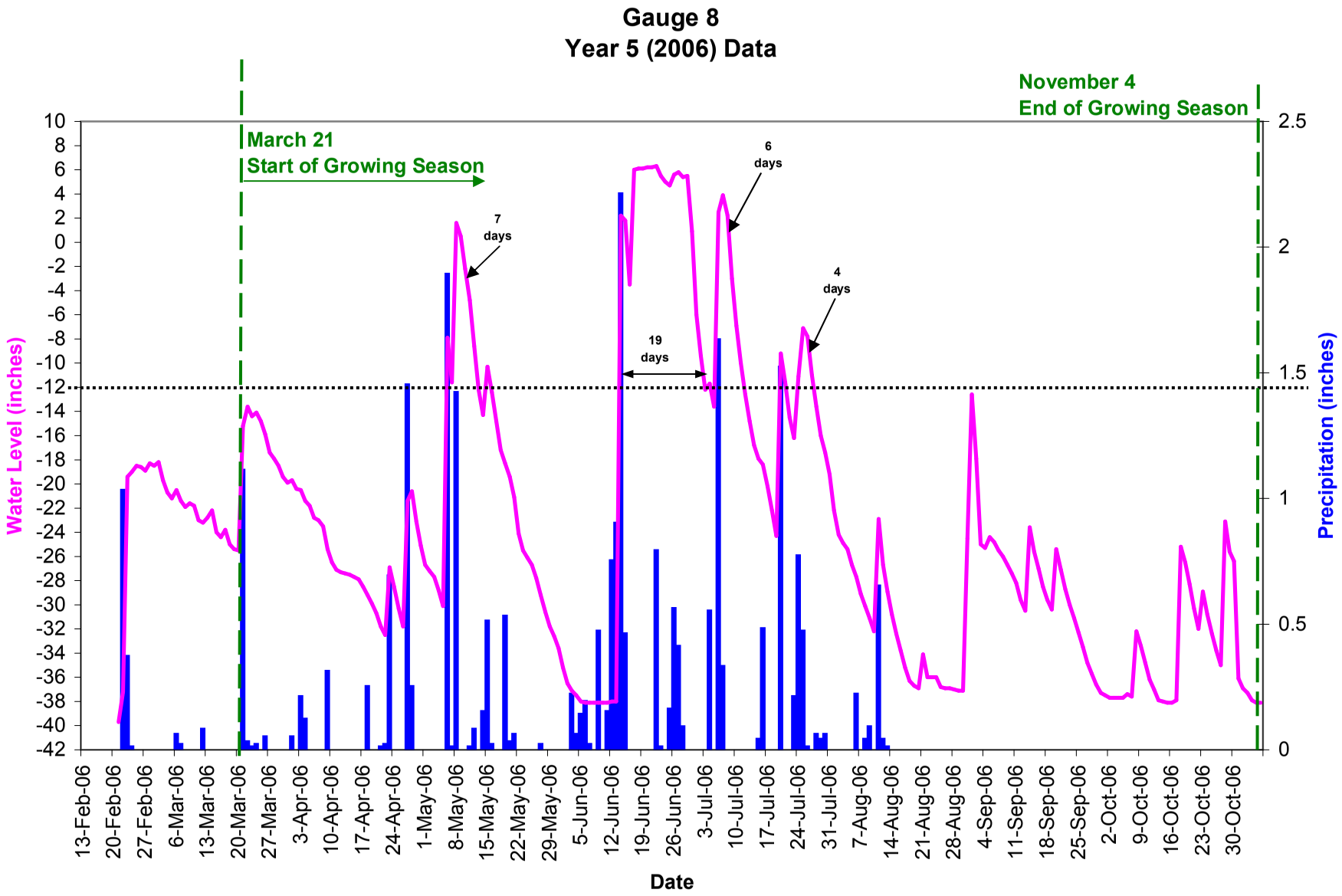

Gauge 3
Year 5 (2006) Data
March 21
Start of Growing Season
November 4
End of Growing Season
6 days
3 days
5 days
2 days
8 days
5 days
3 days
Water Level (inches)
Precipitation (inches)
Date
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
2.5
2
1.5
1
0.5
0
13-Feb-06
21-Feb-06
1-Mar-06
9-Mar-06
17-Mar-06
24-Mar-06
1-Apr-06
9-Apr-06
17-Apr-06
25-Apr-06
3-May-06
11-May-06
19-May-06
27-May-06
4-Jun-06
12-Jun-06
19-Jun-06
27-Jun-06
5-Jul-06
13-Jul-06
21-Jul-06
29-Jul-06
6-Aug-06
14-Aug-06
22-Aug-06
30-Aug-06
7-Sep-06
15-Sep-06
23-Sep-06
1-Oct-06
9-Oct-06
17-Oct-06
25-Oct-06
2-Nov-06

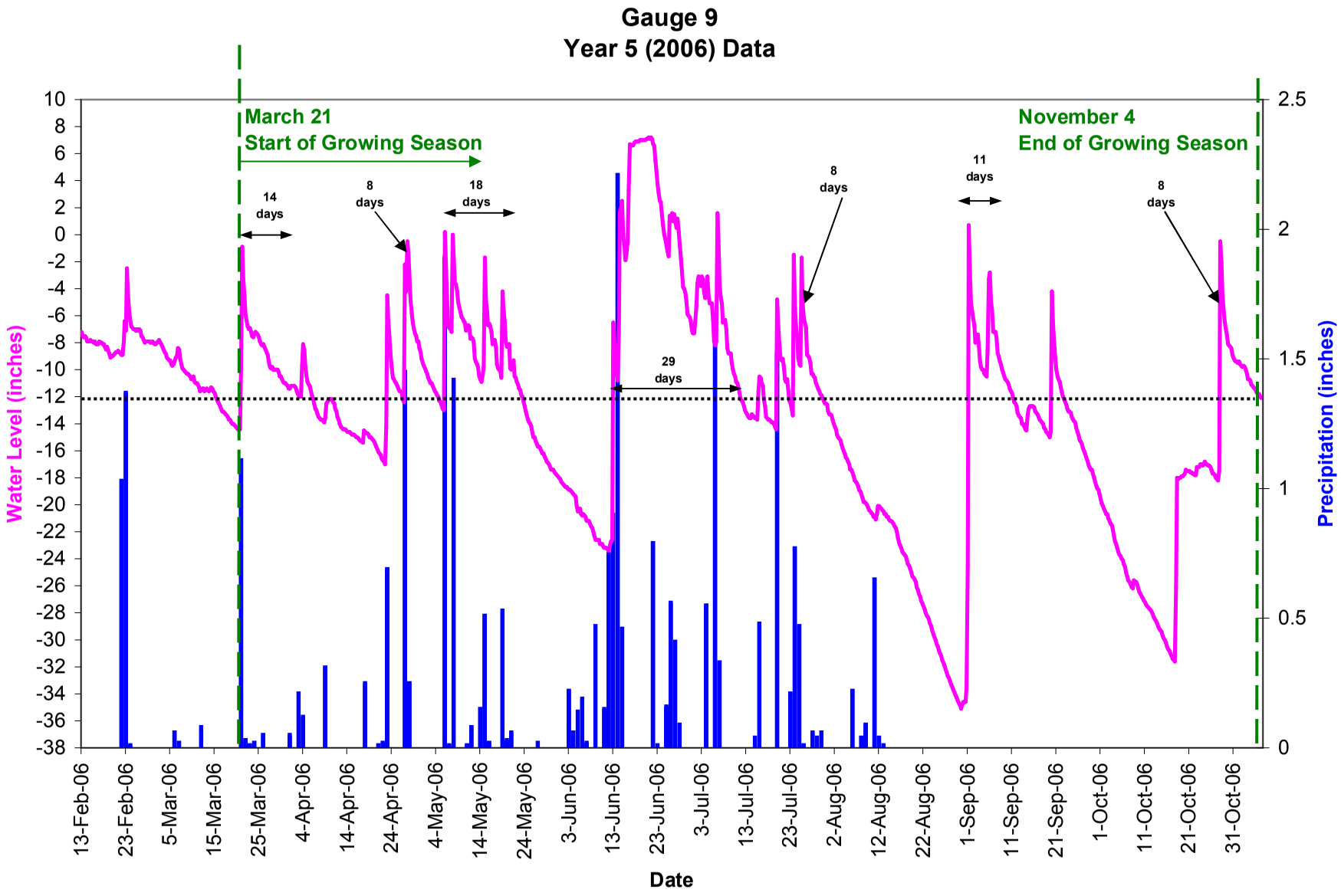

Gauge 4
Year 5 (2006) Data
March 21
Start of Growing Season
November 4
End of Growing Season
76
days
66
days
27
days
Water Level (inches)
Precipitation (inches)
Date
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
2.5
2
1.5
1
0.5
0
13-Feb-06
20-Feb-06
27-Feb-06
6-Mar-06
13-Mar-06
20-Mar-06
27-Mar-06
3-Apr-06
10-Apr-06
17-Apr-06
24-Apr-06
1-May-06
8-May-06
15-May-06
22-May-06
29-May-06
5-Jun-06
12-Jun-06
19-Jun-06
26-Jun-06
3-Jul-06
10-Jul-06
17-Jul-06
24-Jul-06
31-Jul-06
7-Aug-06
14-Aug-06
21-Aug-06
28-Aug-06
4-Sep-06
11-Sep-06
18-Sep-06
25-Sep-06
2-Oct-06
9-Oct-06
16-Oct-06
23-Oct-06
30-Oct-06

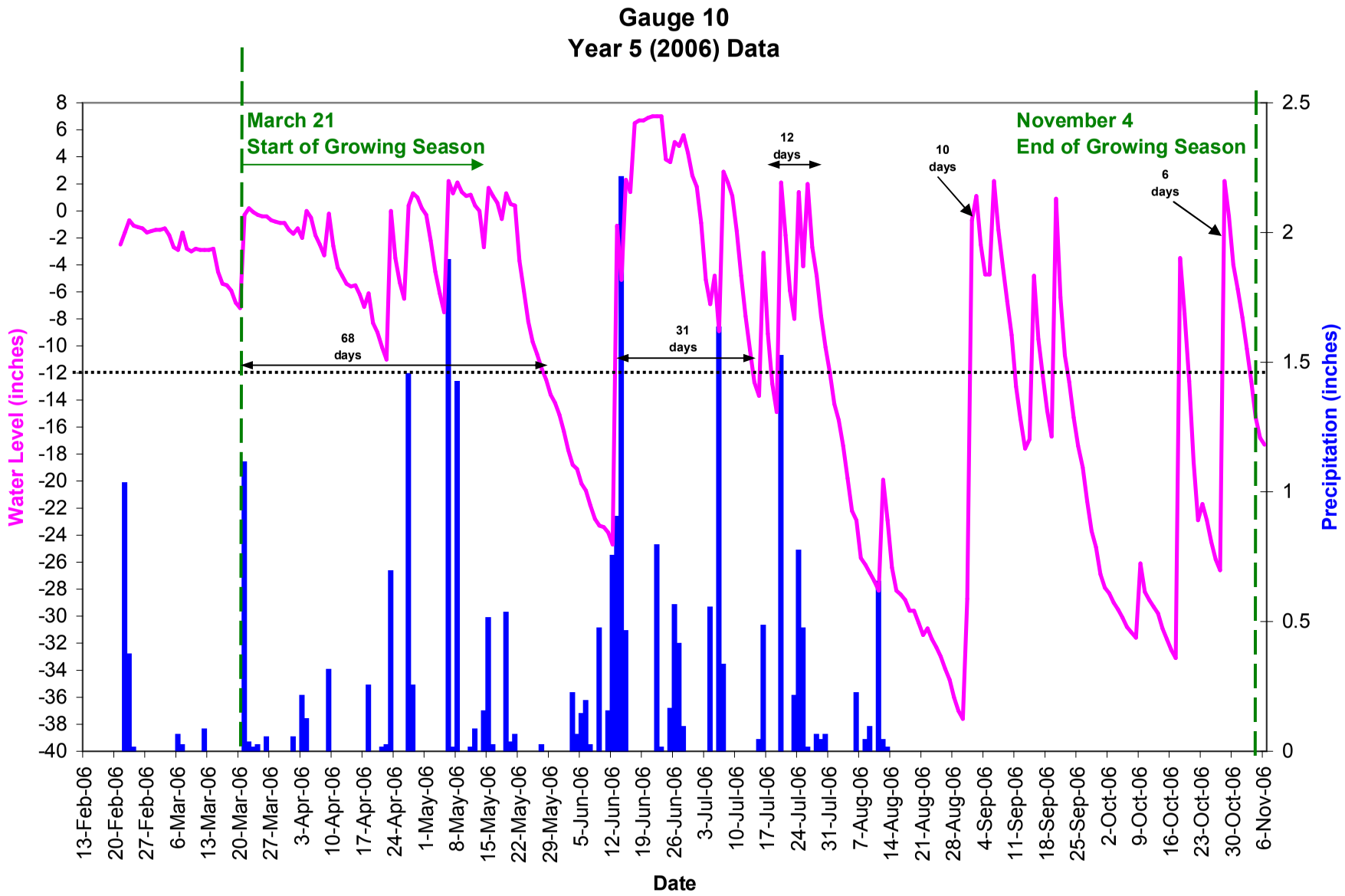

Gauge 5
Year 5 (2006) Data
March 21
Start of Growing Season
November 4
End of Growing Season
229
days
Water Level (inches)
Precipitation (inches)
Date
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
2.5
2
1.5
1
0.5
0
13-Feb-06
20-Feb-06
27-Feb-06
6-Mar-06
13-Mar-06
20-Mar-06
27-Mar-06
3-Apr-06
10-Apr-06
17-Apr-06
24-Apr-06
1-May-06
8-May-06
15-May-06
22-May-06
29-May-06
5-Jun-06
12-Jun-06
19-Jun-06
26-Jun-06
3-Jul-06
10-Jul-06
17-Jul-06
24-Jul-06
31-Jul-06
7-Aug-06
14-Aug-06
21-Aug-06
28-Aug-06
4-Sep-06
11-Sep-06
18-Sep-06
25-Sep-06
2-Oct-06
9-Oct-06
16-Oct-06
23-Oct-06
30-Oct-06

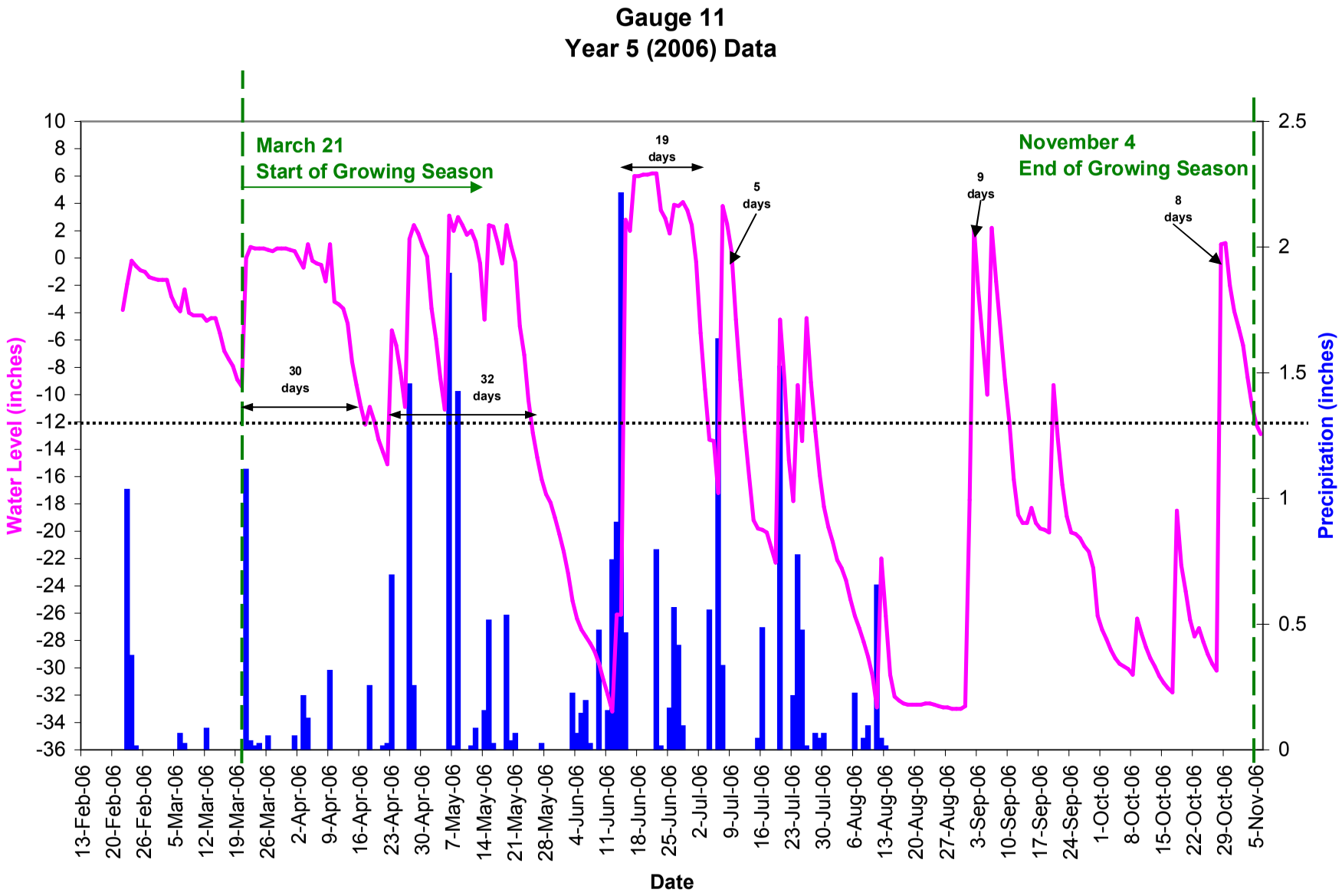

Gauge 6
Year 5 (2006) Data
March 21
Start of Growing Season
8 days
11 days
10 days
33 days
30 days
Water Level (inches)
Precipitation (inches)
Date
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2
1.5
1
0.5
0
2/13/2006
2/23/2006
3/5/2006
3/15/2006
3/25/2006
4/4/2006
4/14/2006
4/24/2006
5/4/2006
5/14/2006
5/24/2006
6/3/2006
6/13/2006
6/23/2006
7/3/2006
7/13/2006
7/23/2006
8/2/2006
8/12/2006
8/22/2006
9/1/2006
9/11/2006
9/21/2006
10/1/2006
10/11/2006
10/21/2006
10/31/2006

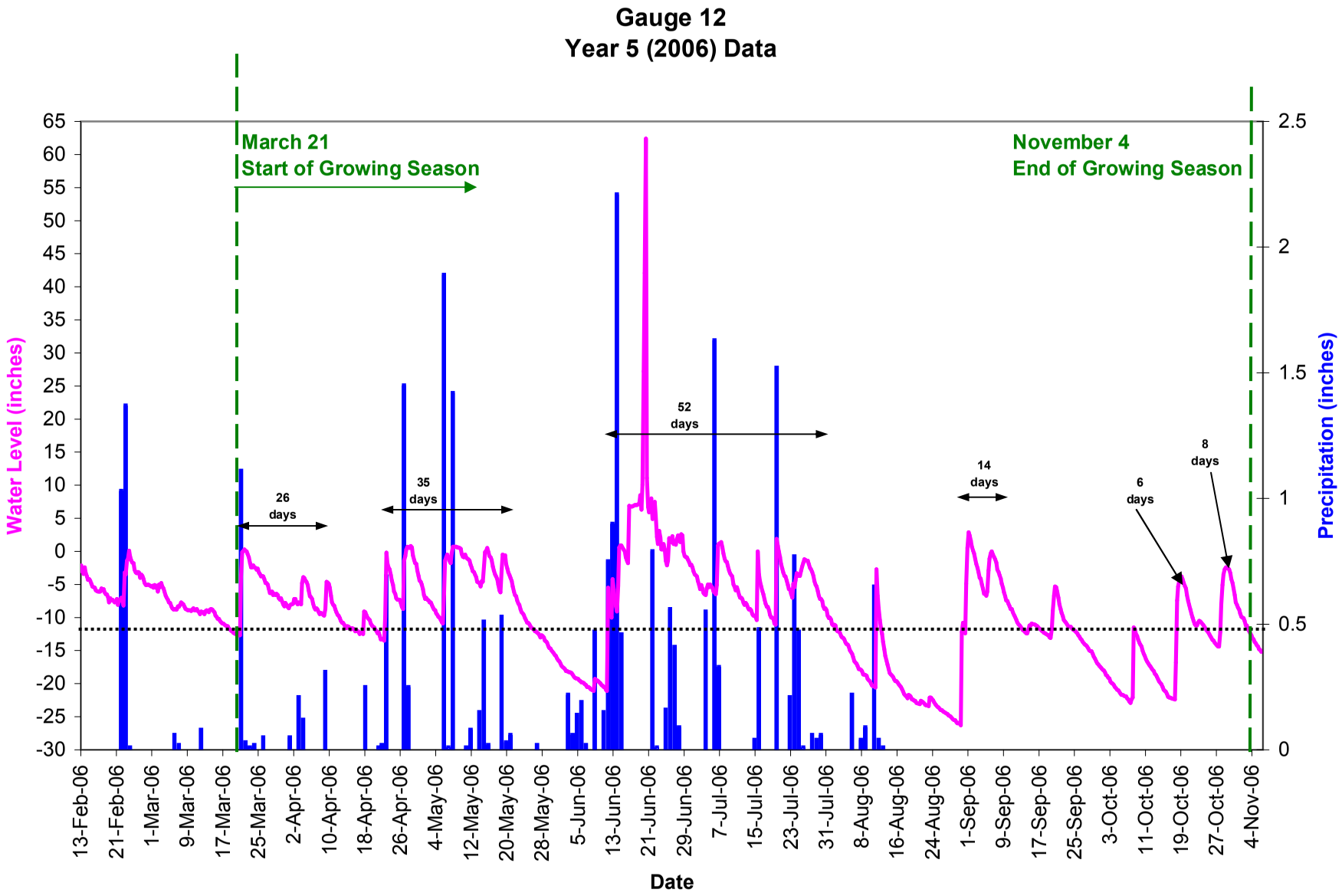

Gauge 7
Year 5 (2006) Data
March 21
Start of Growing Season
November 4
End of Growing Season
sporadic
gauge malfunctions
168
days
3
days
9
days
Water Level (inches)
Precipitation (inches)
Date
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
2.5
2
1.5
1
0.5
0
13-Feb-2006
21-Feb-2006
01-Mar-2006
09-Mar-2006
17-Mar-2006
25-Mar-2006
02-Apr-2006
10-Apr-2006
18-Apr-2006
26-Apr-2006
4-May-2006
12-May-2006
20-May-2006
28-May-2006
5-Jun-2006
13-Jun-2006
21-Jun-2006
29-Jun-2006
7-Jul-2006
15-Jul-2006
23-Jul-2006
31-Jul-2006
8-Aug-2006
16-Aug-2006
24-Aug-2006
1-Sep-2006
9-Sep-2006
17-Sep-2006
25-Sep-2006
3-Oct-2006
11-Oct-2006
19-Oct-2006
27-Oct-2006
4-Nov-2006

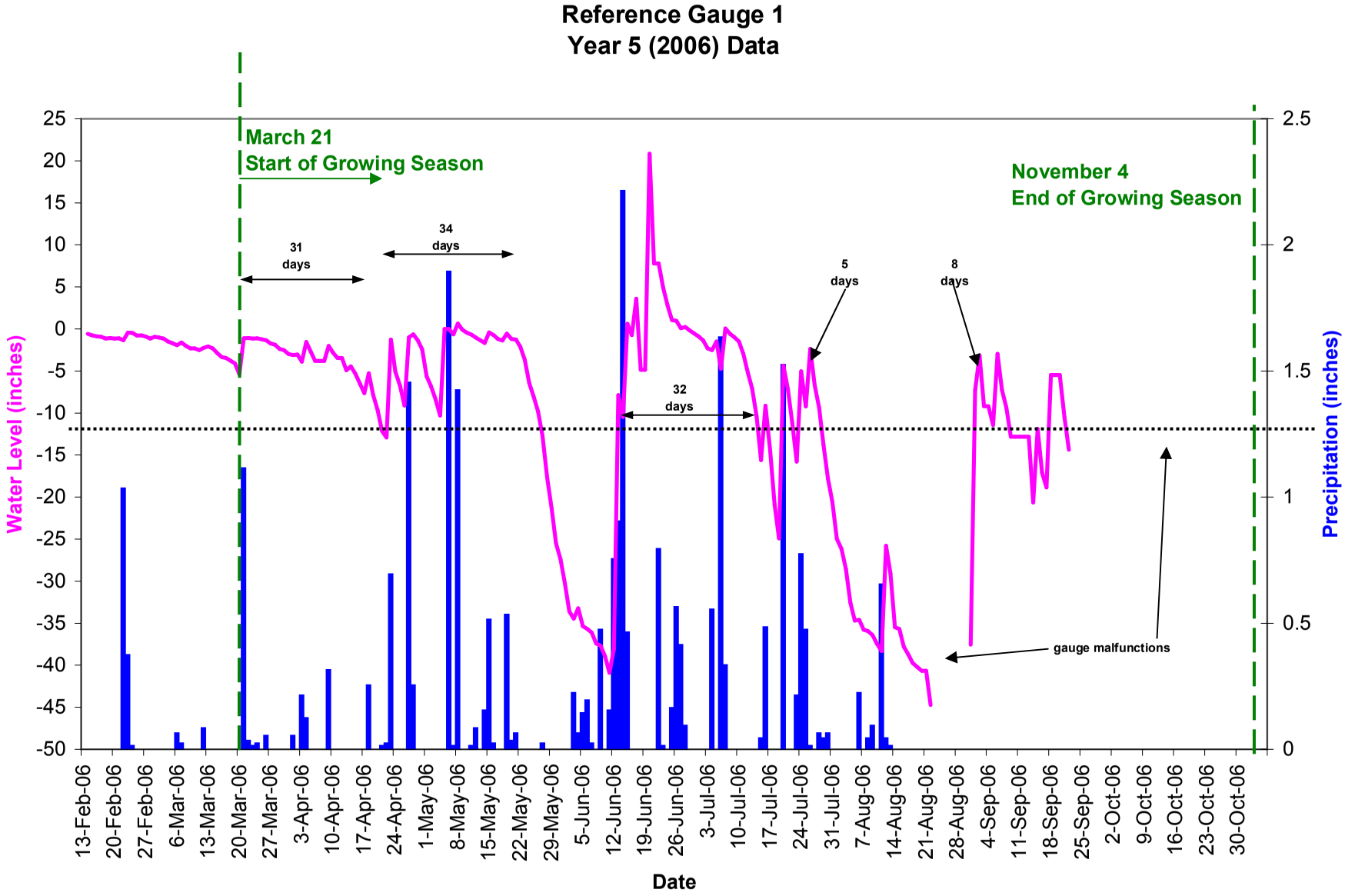

Gauge 8
Year 5 (2006) Data
November 4
End of Growing Season
March 21
Start of Growing Season
7
days
6
days
4
days
19
days
Water Level (inches)
Precipitation (inches)
Date
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
-42
2.5
2
1.5
1
0.5
0
13-Feb-06
20-Feb-06
27-Feb-06
6-Mar-06
13-Mar-06
20-Mar-06
27-Mar-06
3-Apr-06
10-Apr-06
17-Apr-06
24-Apr-06
1-May-06
8-May-06
15-May-06
22-May-06
29-May-06
5-Jun-06
12-Jun-06
19-Jun-06
26-Jun-06
3-Jul-06
10-Jul-06
17-Jul-06
24-Jul-06
31-Jul-06
7-Aug-06
14-Aug-06
21-Aug-06
28-Aug-06
4-Sep-06
11-Sep-06
18-Sep-06
25-Sep-06
2-Oct-06
9-Oct-06
16-Oct-06
23-Oct-06
30-Oct-06

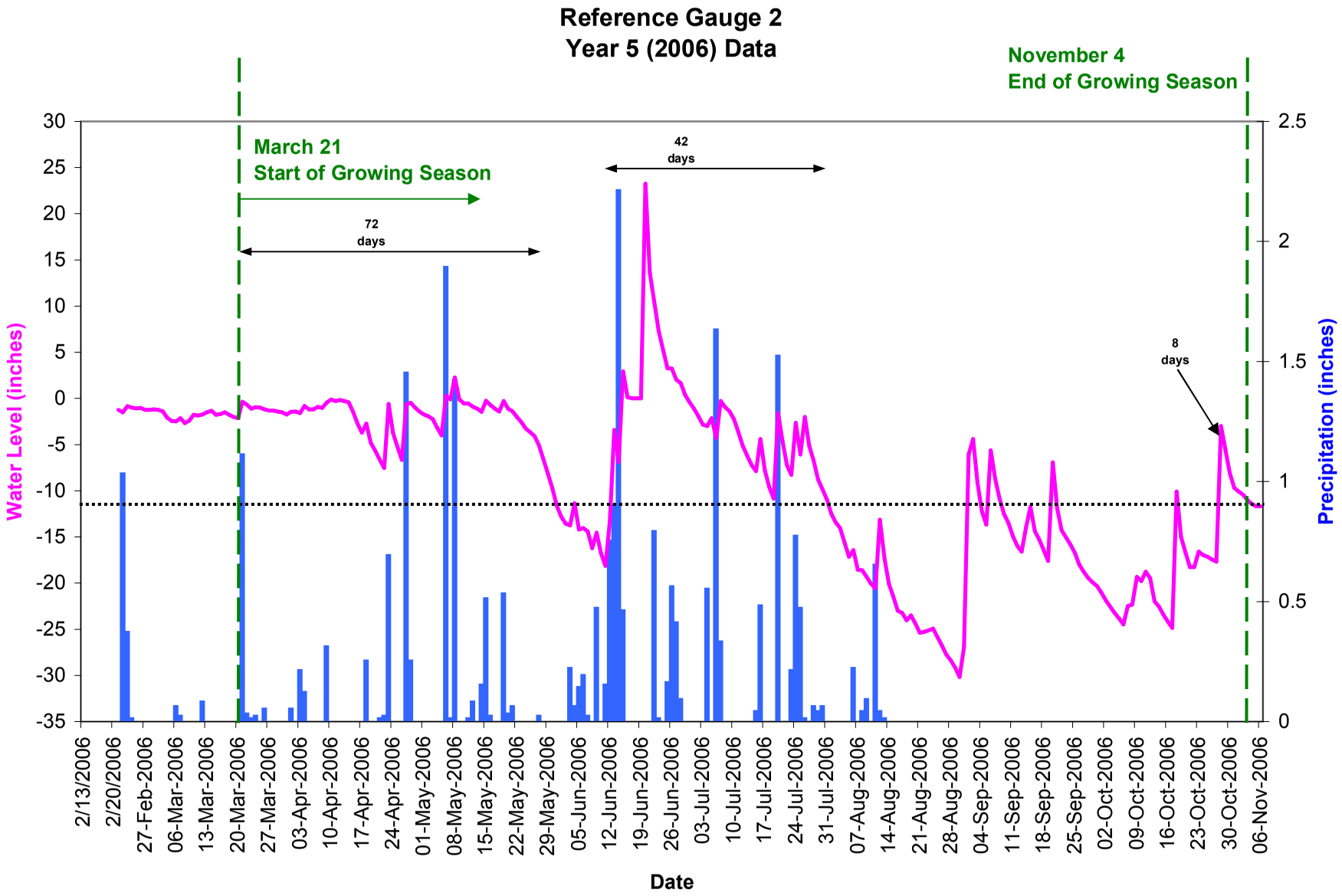

Gauge 9
Year 5 (2006) Data
March 21
Start of Growing Season
November 4
End of Growing Season
14 days
8 days
18 days
29 days
8 days
11 days
8 days
Water Level (inches)
Precipitation (inches)
Date
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
2.5
2
1.5
1
0.5
0
13-Feb-06
23-Feb-06
5-Mar-06
15-Mar-06
25-Mar-06
4-Apr-06
14-Apr-06
24-Apr-06
4-May-06
14-May-06
24-May-06
3-Jun-06
13-Jun-06
23-Jun-06
3-Jul-06
13-Jul-06
23-Jul-06
2-Aug-06
12-Aug-06
22-Aug-06
1-Sep-06
11-Sep-06
21-Sep-06
1-Oct-06
11-Oct-06
21-Oct-06
31-Oct-06


Gauge 10
Year 5 (2006) Data
March 21
Start of Growing Season
November 4
End of Growing Season
68 days
31 days
12 days
10 days
6 days
Water Level (inches)
Precipitation (inches)
Date
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
2.5
2
1.5
1
0.5
0
13-Feb-06
20-Feb-06
27-Feb-06
6-Mar-06
13-Mar-06
20-Mar-06
27-Mar-06
3-Apr-06
10-Apr-06
17-Apr-06
24-Apr-06
1-May-06
8-May-06
15-May-06
22-May-06
29-May-06
5-Jun-06
12-Jun-06
19-Jun-06
26-Jun-06
3-Jul-06
10-Jul-06
17-Jul-06
24-Jul-06
31-Jul-06
7-Aug-06
14-Aug-06
21-Aug-06
28-Aug-06
4-Sep-06
11-Sep-06
18-Sep-06
25-Sep-06
2-Oct-06
9-Oct-06
16-Oct-06
23-Oct-06
30-Oct-06
6-Nov-06


Gauge 11
Year 5 (2006) Data
March 21
Start of Growing Season
November 4
End of Growing Season
19 days
5 days
9 days
8 days
30 days
32 days
Water Level (inches)
Precipitation (inches)
Date
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
2.5
2
1.5
1
0.5
0
13-Feb-06
20-Feb-06
26-Feb-06
5-Mar-06
12-Mar-06
19-Mar-06
26-Mar-06
2-Apr-06
9-Apr-06
16-Apr-06
23-Apr-06
30-Apr-06
7-May-06
14-May-06
21-May-06
28-May-06
4-Jun-06
11-Jun-06
18-Jun-06
25-Jun-06
2-Jul-06
9-Jul-06
16-Jul-06
23-Jul-06
30-Jul-06
6-Aug-06
13-Aug-06
20-Aug-06
27-Aug-06
3-Sep-06
10-Sep-06
17-Sep-06
24-Sep-06
1-Oct-06
8-Oct-06
15-Oct-06
22-Oct-06
29-Oct-06
5-Nov-06


Gauge 12
Year 5 (2006) Data
March 21
Start of Growing Season
November 4
End of Growing Season
26 days
35 days
52 days
14 days
6 days
8 days
Water Level (inches)
Precipitation (inches)
Date
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
2.5
2
1.5
1
0.5
0
13-Feb-06
21-Feb-06
1-Mar-06
9-Mar-06
17-Mar-06
25-Mar-06
2-Apr-06
10-Apr-06
18-Apr-06
26-Apr-06
4-May-06
12-May-06
20-May-06
28-May-06
5-Jun-06
13-Jun-06
21-Jun-06
29-Jun-06
7-Jul-06
15-Jul-06
23-Jul-06
31-Jul-06
8-Aug-06
16-Aug-06
24-Aug-06
1-Sep-06
9-Sep-06
17-Sep-06
25-Sep-06
3-Oct-06
11-Oct-06
19-Oct-06
27-Oct-06
4-Nov-06

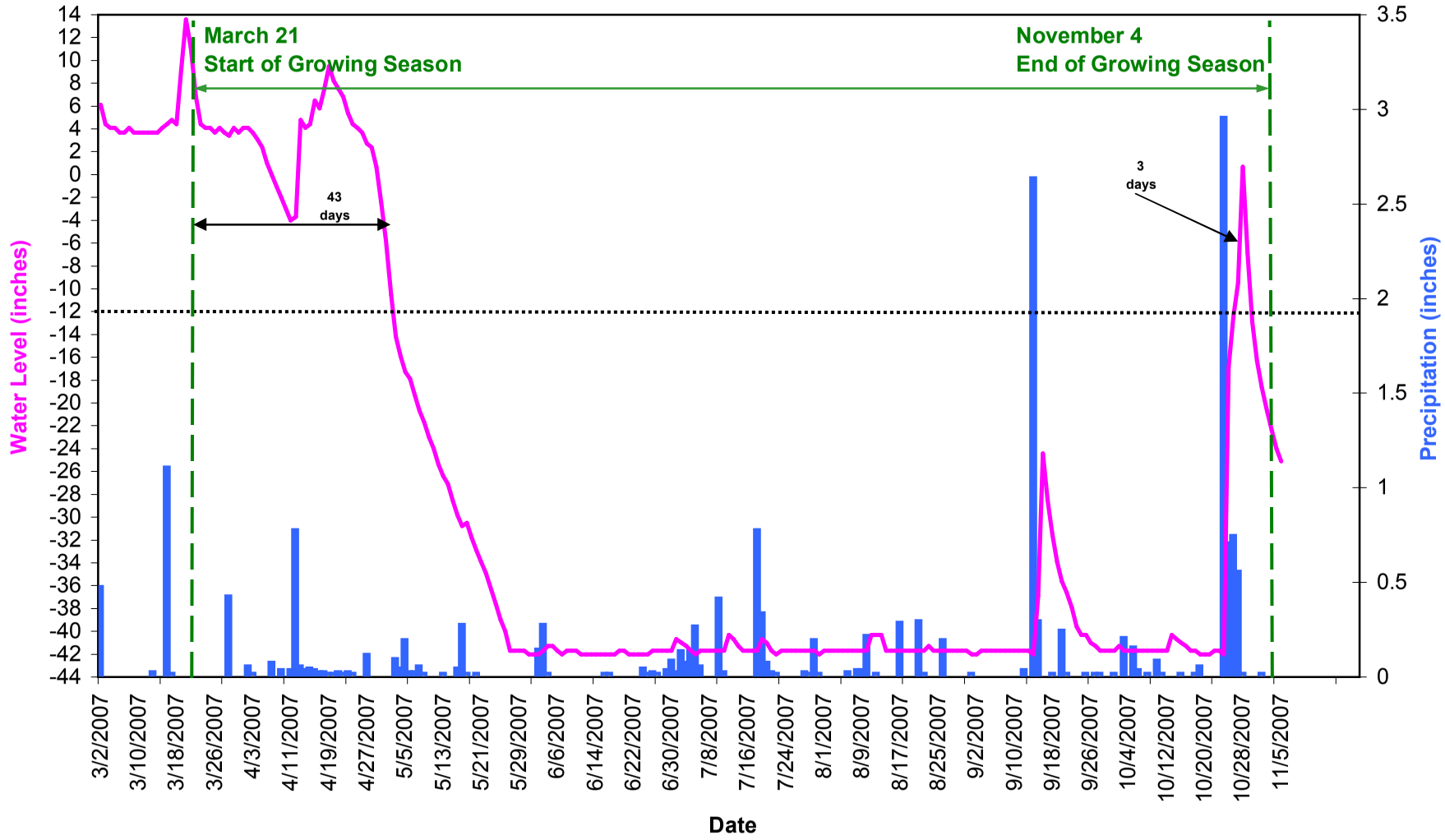

Reference Gauge 1
Year 5 (2006) Data
March 21
Start of Growing Season
November 4
End of Growing Season
31 days
34 days
32 days
5 days
8 days
gauge malfunctions
Water Level (inches)
Precipitation (inches)
Date
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
2.5
2
1.5
1
0.5
0
13-Feb-06
20-Feb-06
27-Feb-06
6-Mar-06
13-Mar-06
20-Mar-06
27-Mar-06
3-Apr-06
10-Apr-06
17-Apr-06
24-Apr-06
1-May-06
8-May-06
15-May-06
22-May-06
29-May-06
5-Jun-06
12-Jun-06
19-Jun-06
26-Jun-06
3-Jul-06
10-Jul-06
17-Jul-06
24-Jul-06
31-Jul-06
7-Aug-06
14-Aug-06
21-Aug-06
28-Aug-06
4-Sep-06
11-Sep-06
18-Sep-06
25-Sep-06
2-Oct-06
9-Oct-06
16-Oct-06
23-Oct-06
30-Oct-06

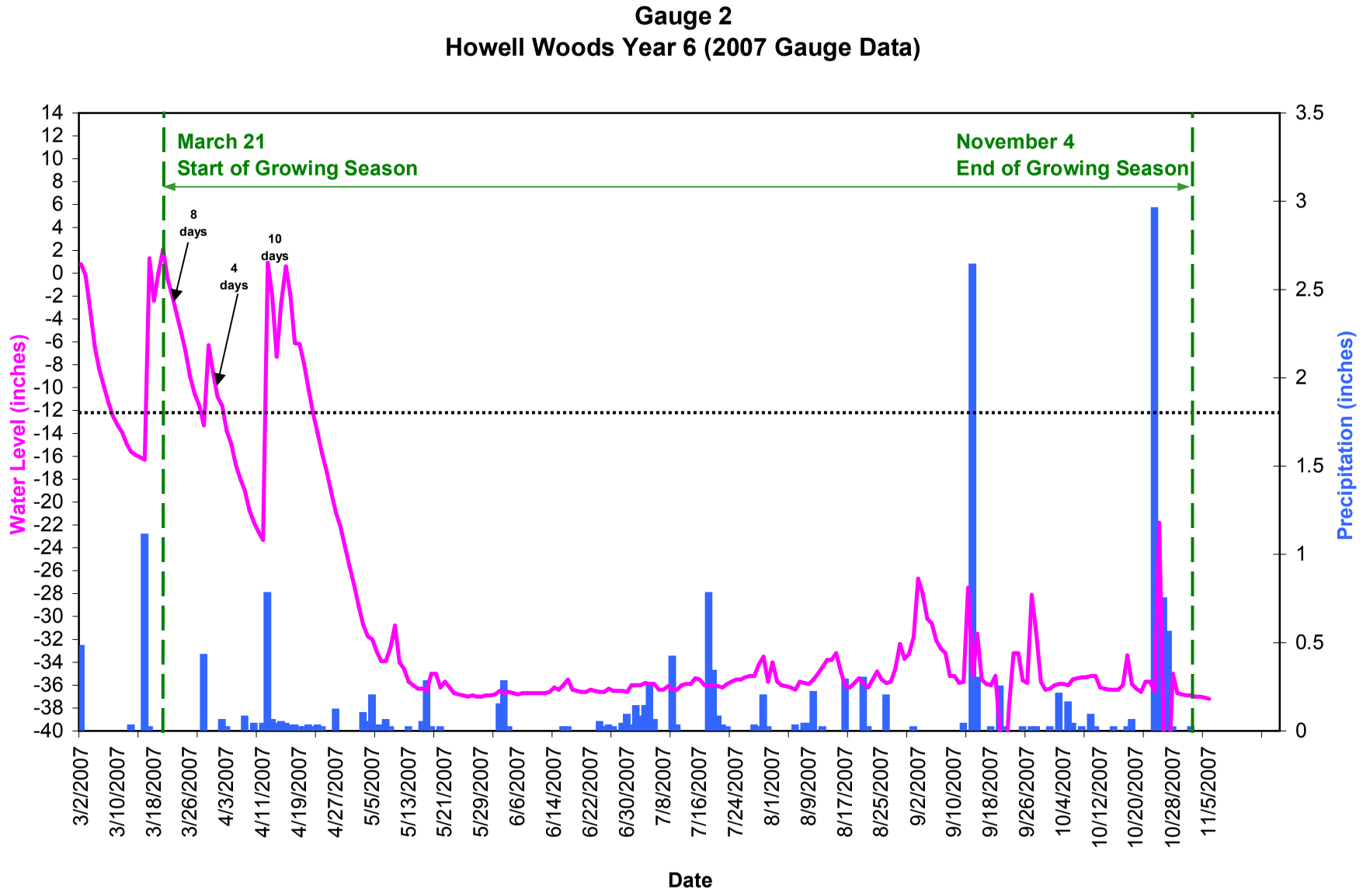

Reference Gauge 2
Year 5 (2006) Data
November 4
End of Growing Season
March 21
Start of Growing Season
72
days
42
days
8
days
Water Level (inches)
Precipitation (inches)
Date
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
2.5
2
1.5
1
0.5
0
2/13/2006
2/20/2006
27-Feb-2006
06-Mar-2006
13-Mar-2006
20-Mar-2006
27-Mar-2006
03-Apr-2006
10-Apr-2006
17-Apr-2006
24-Apr-2006
01-May-2006
08-May-2006
15-May-2006
22-May-2006
29-May-2006
05-Jun-2006
12-Jun-2006
19-Jun-2006
26-Jun-2006
03-Jul-2006
10-Jul-2006
17-Jul-2006
24-Jul-2006
31-Jul-2006
07-Aug-2006
14-Aug-2006
21-Aug-2006
28-Aug-2006
04-Sep-2006
11-Sep-2006
18-Sep-2006
25-Sep-2006
02-Oct-2006
09-Oct-2006
16-Oct-2006
23-Oct-2006
30-Oct-2006
06-Nov-2006

APPENDIX I

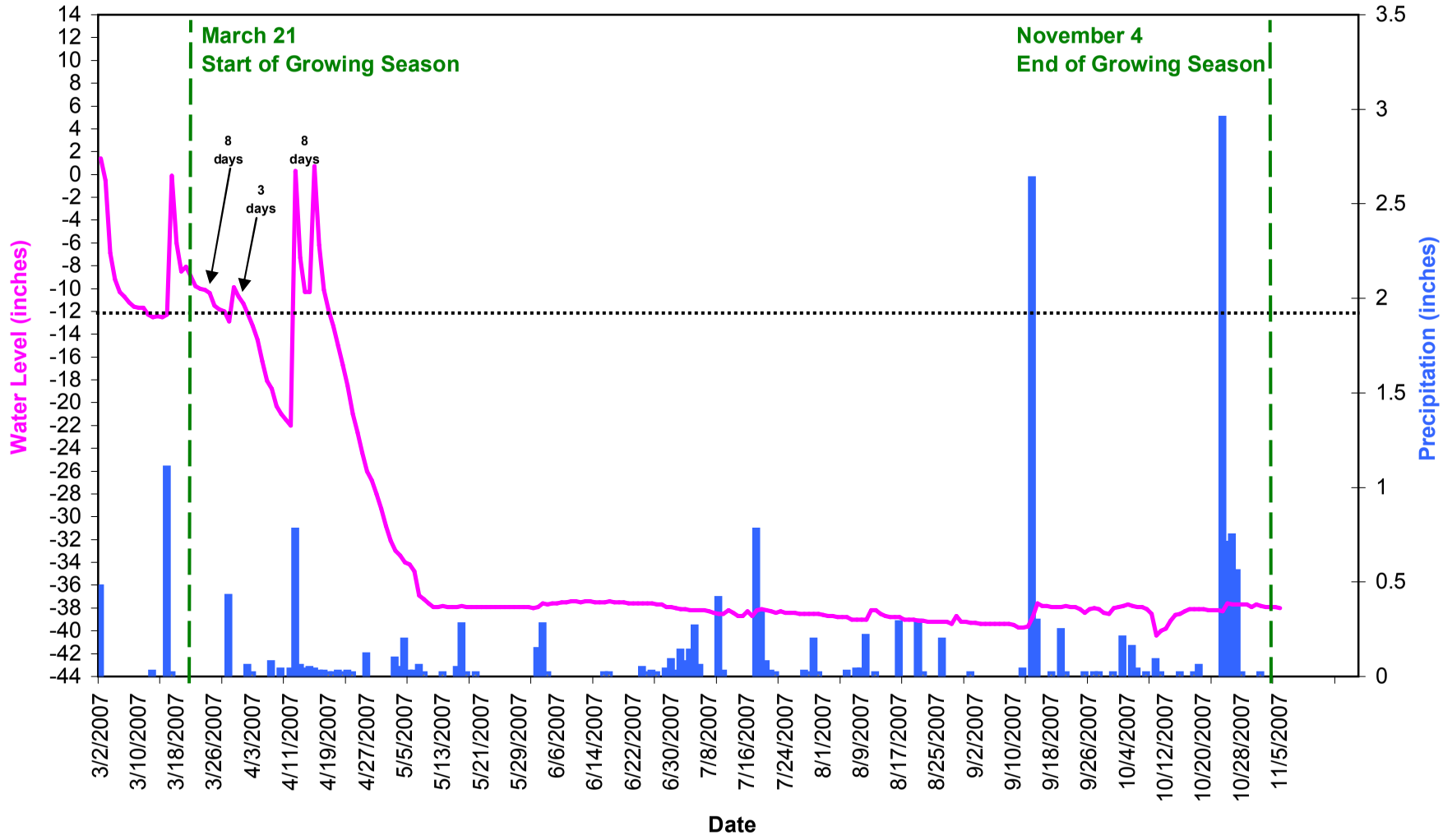
YEAR 6 (2007) GROUNDWATER GAUGE GRAPHS

Gauge 1
Howell Woods Year 6 (2007 Gauge Data)

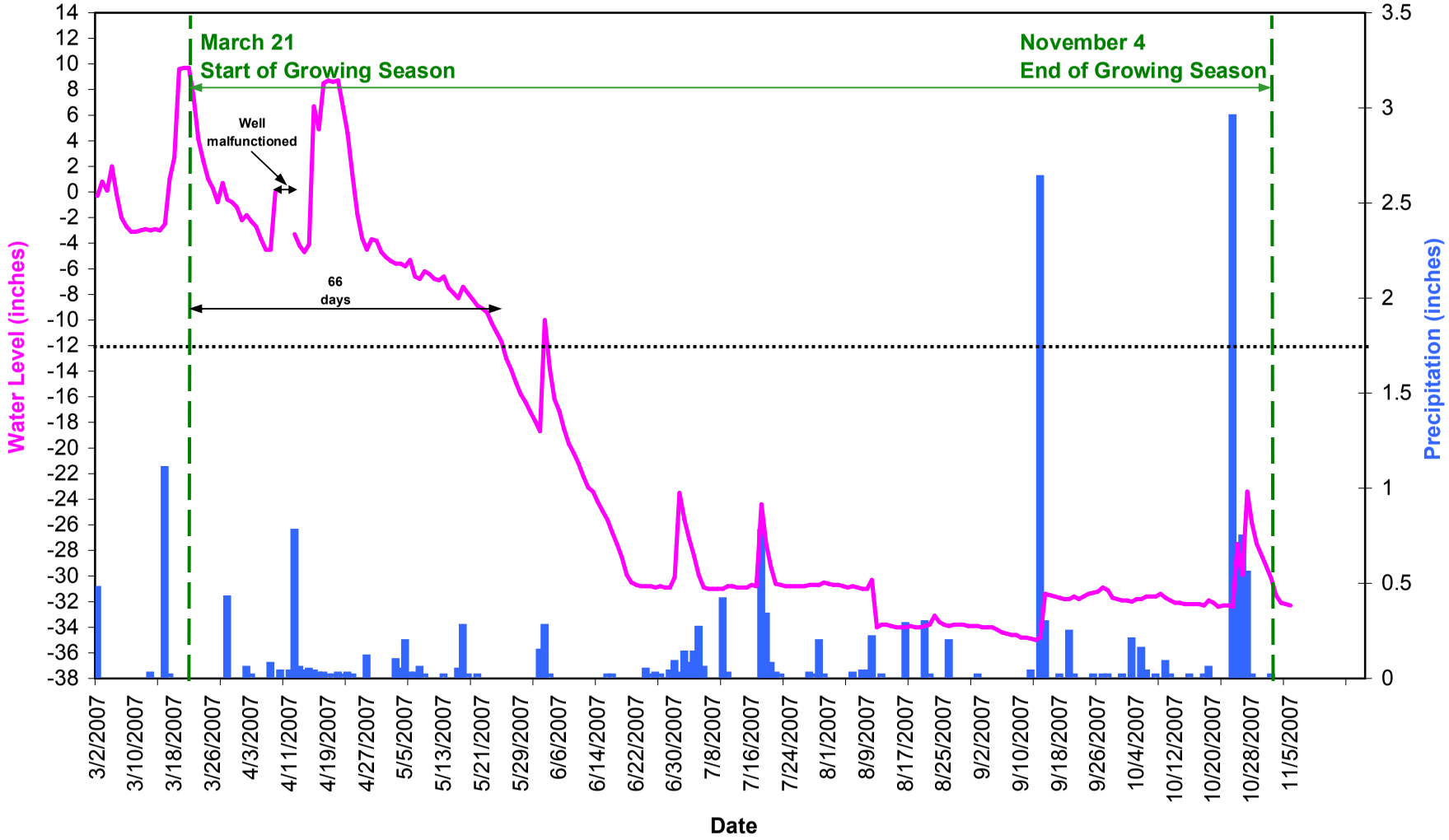



Gauge 2
Howell Woods Year 6 (2007 Gauge Data)
March 21
Start of Growing Season
November 4
End of Growing Season
8 days
4 days
10 days
Water Level (inches)
Precipitation (inches)
Date
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
3.5
3
2.5
2
1.5
1
0.5
0
3/2/2007
3/10/2007
3/18/2007
3/26/2007
4/3/2007
4/11/2007
4/19/2007
4/27/2007
5/5/2007
5/13/2007
5/21/2007
5/29/2007
6/6/2007
6/14/2007
6/22/2007
6/30/2007
7/8/2007
7/16/2007
7/24/2007
8/1/2007
8/9/2007
8/17/2007
8/25/2007
9/2/2007
9/10/2007
9/18/2007
9/26/2007
10/4/2007
10/12/2007
10/20/2007
10/28/2007
11/5/2007

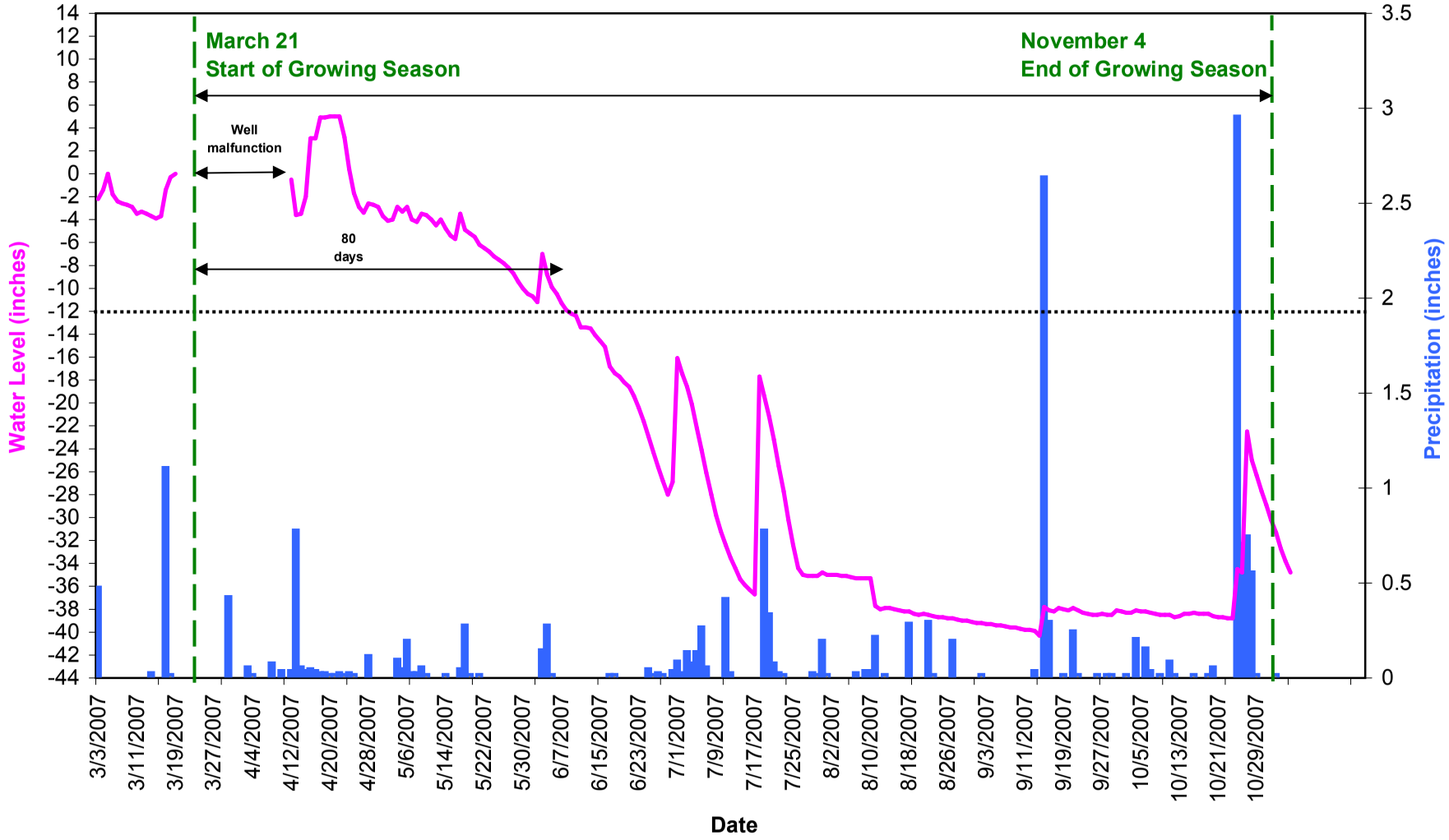
Gauge 3
Howell Woods Year 6 (2007 Gauge Data)



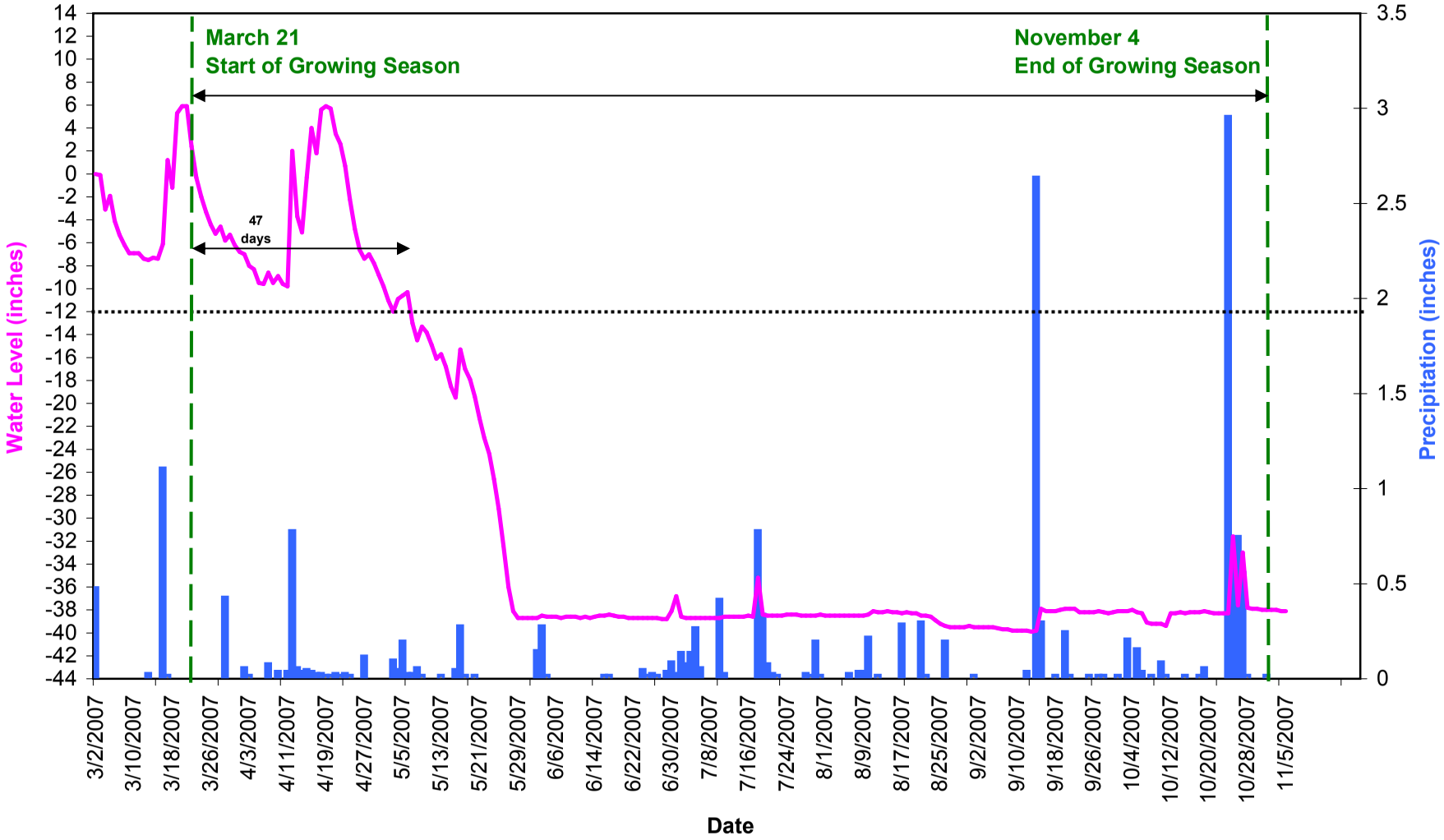
Gauge 4
Howell Woods Year 6 (2007 Gauge Data)



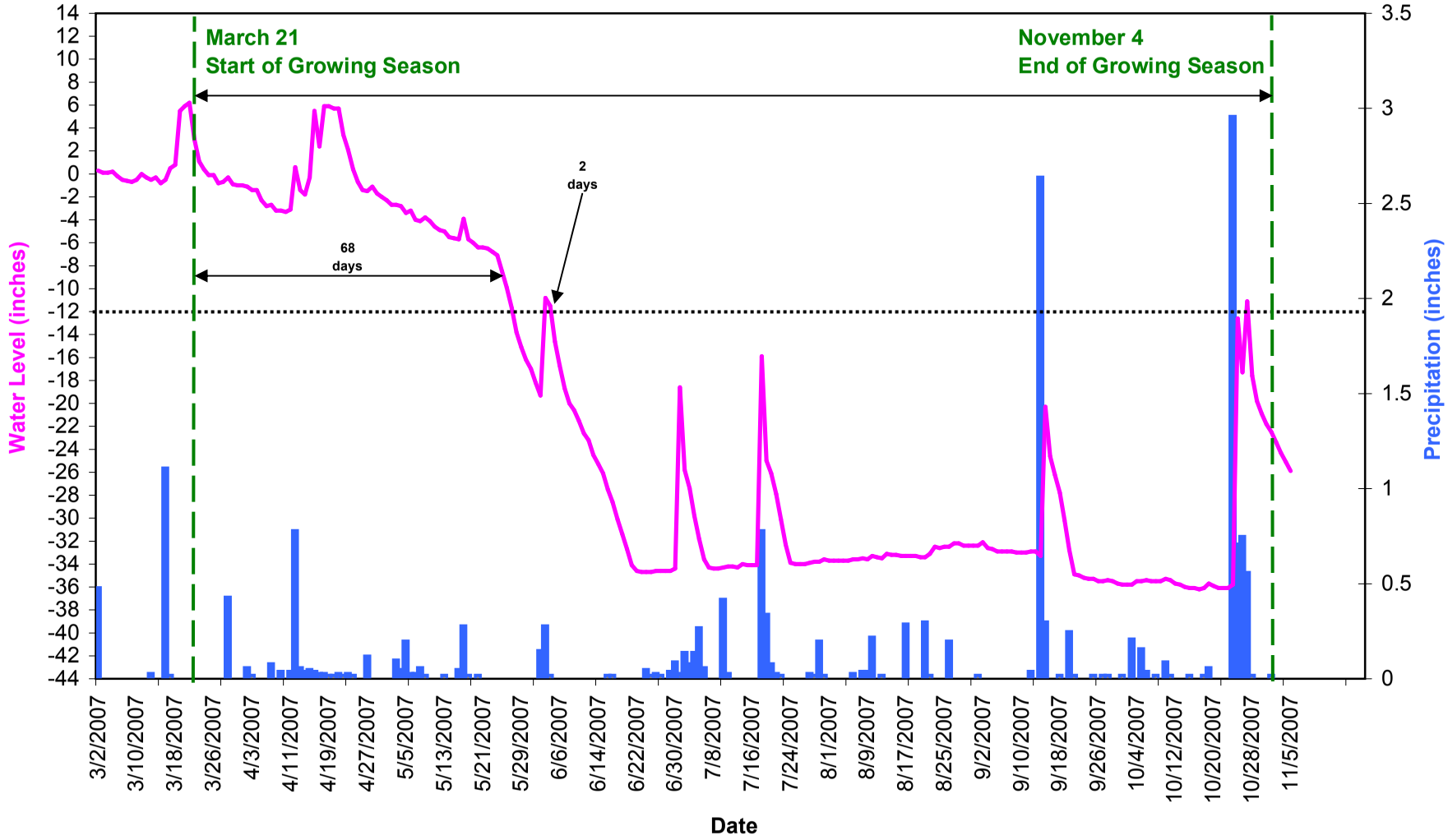
Gauge 5
Howell Woods Year 6 (2007 Gauge Data)



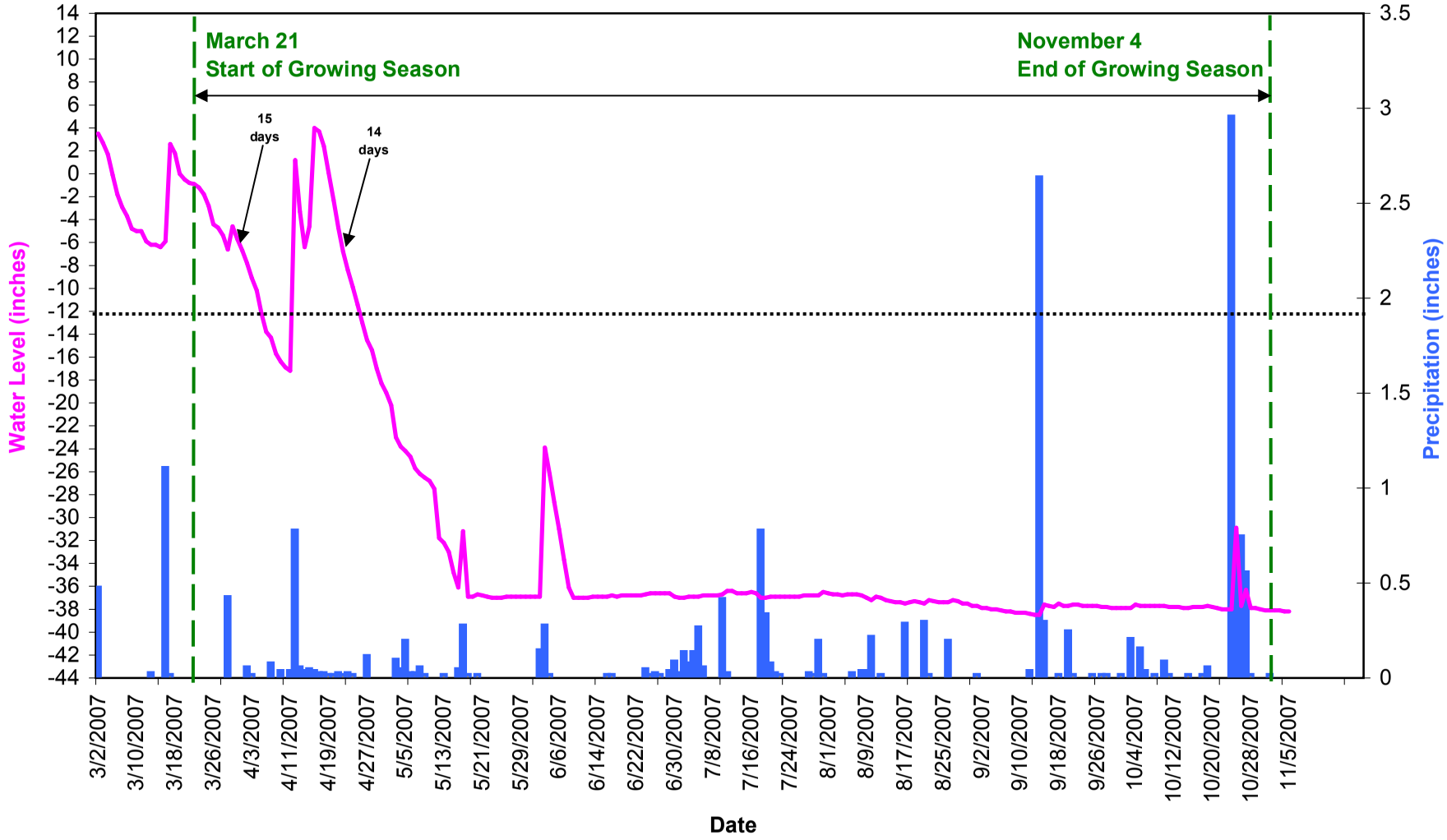
Gauge 6
Howell Woods Year 6 (2007 Gauge Data)



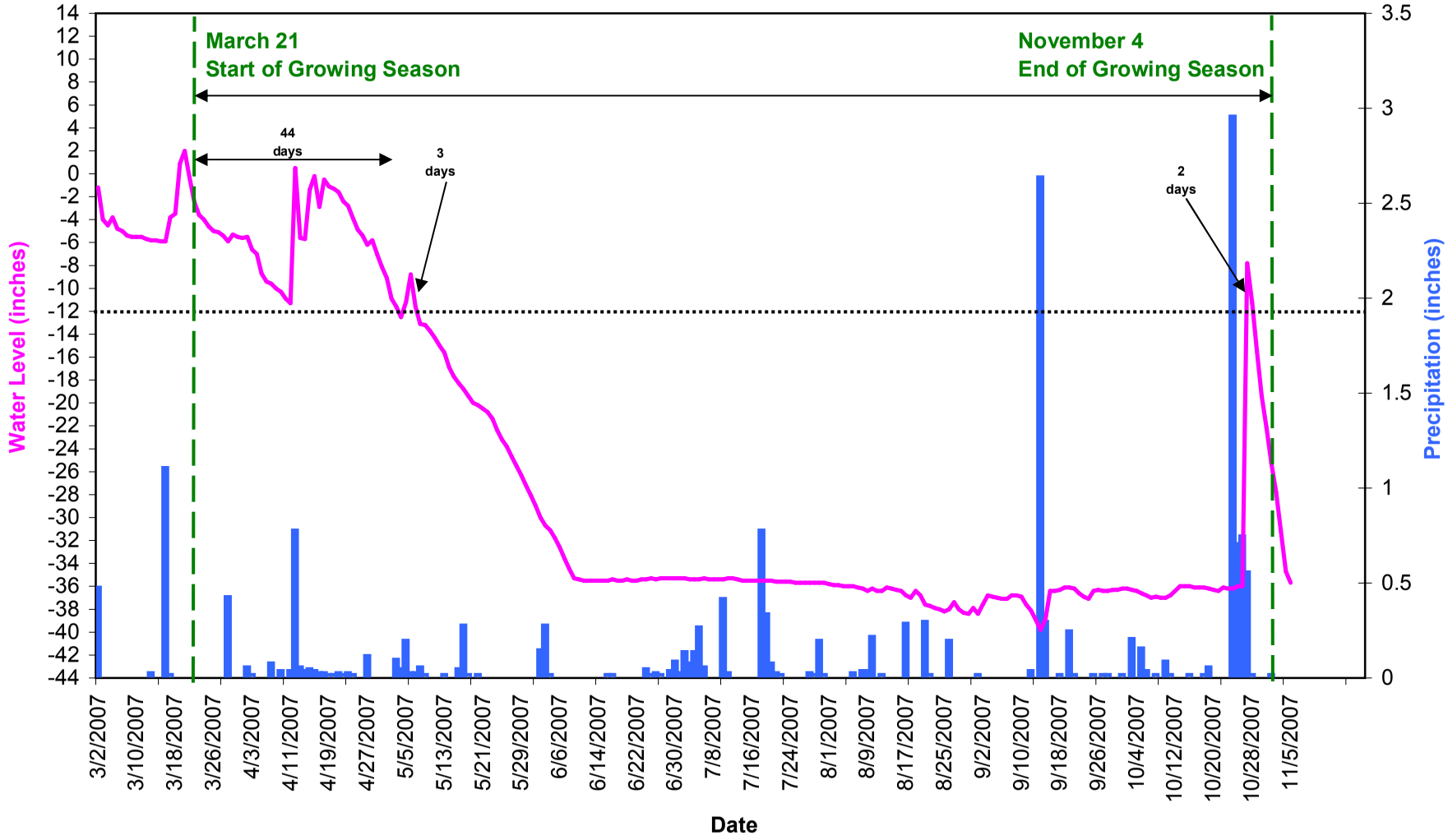
Gauge 7
Howell Woods Year 6 (2007 Gauge Data)



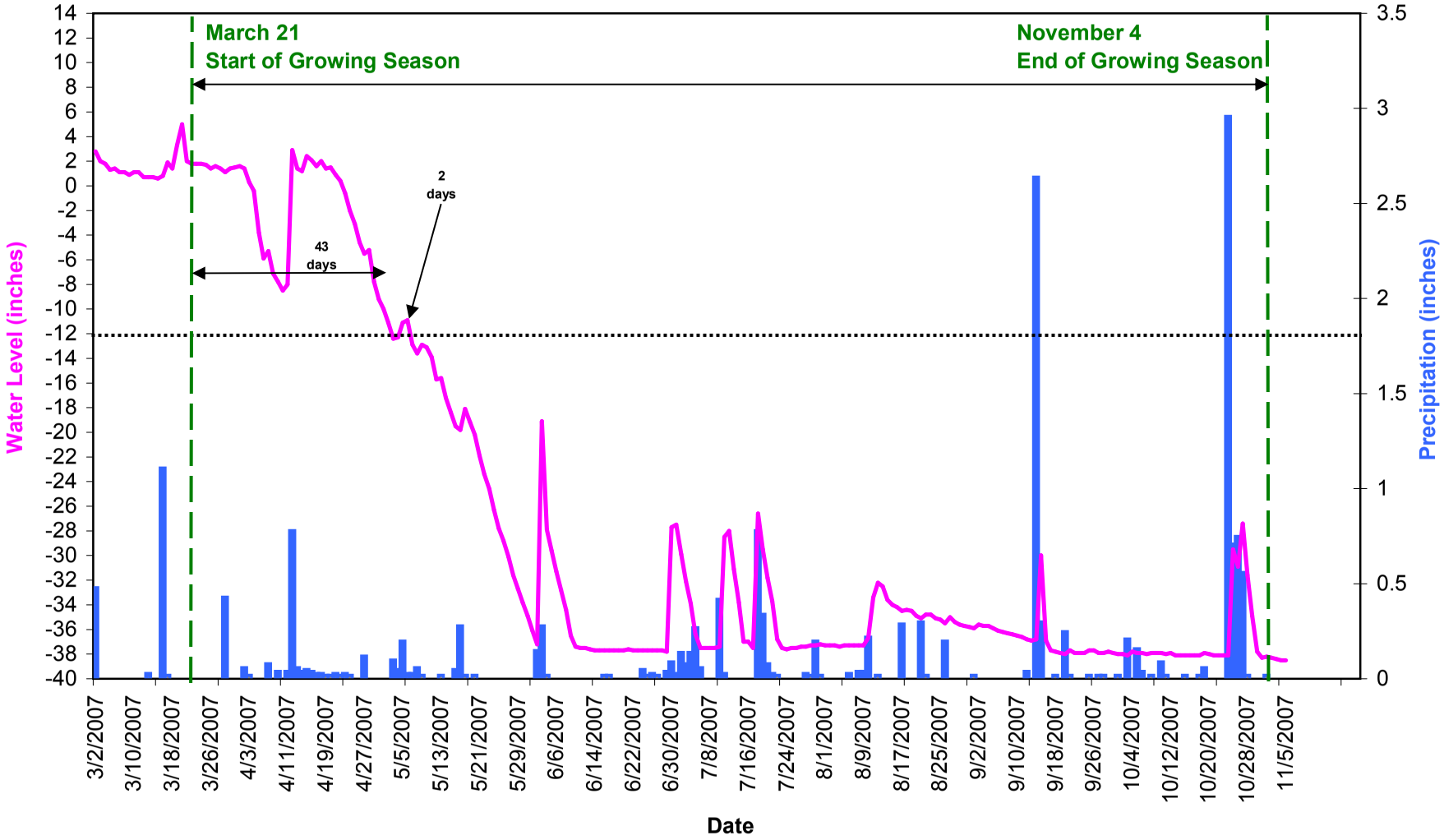
Gauge 8
Howell Woods Year 6 (2007 Gauge Data)



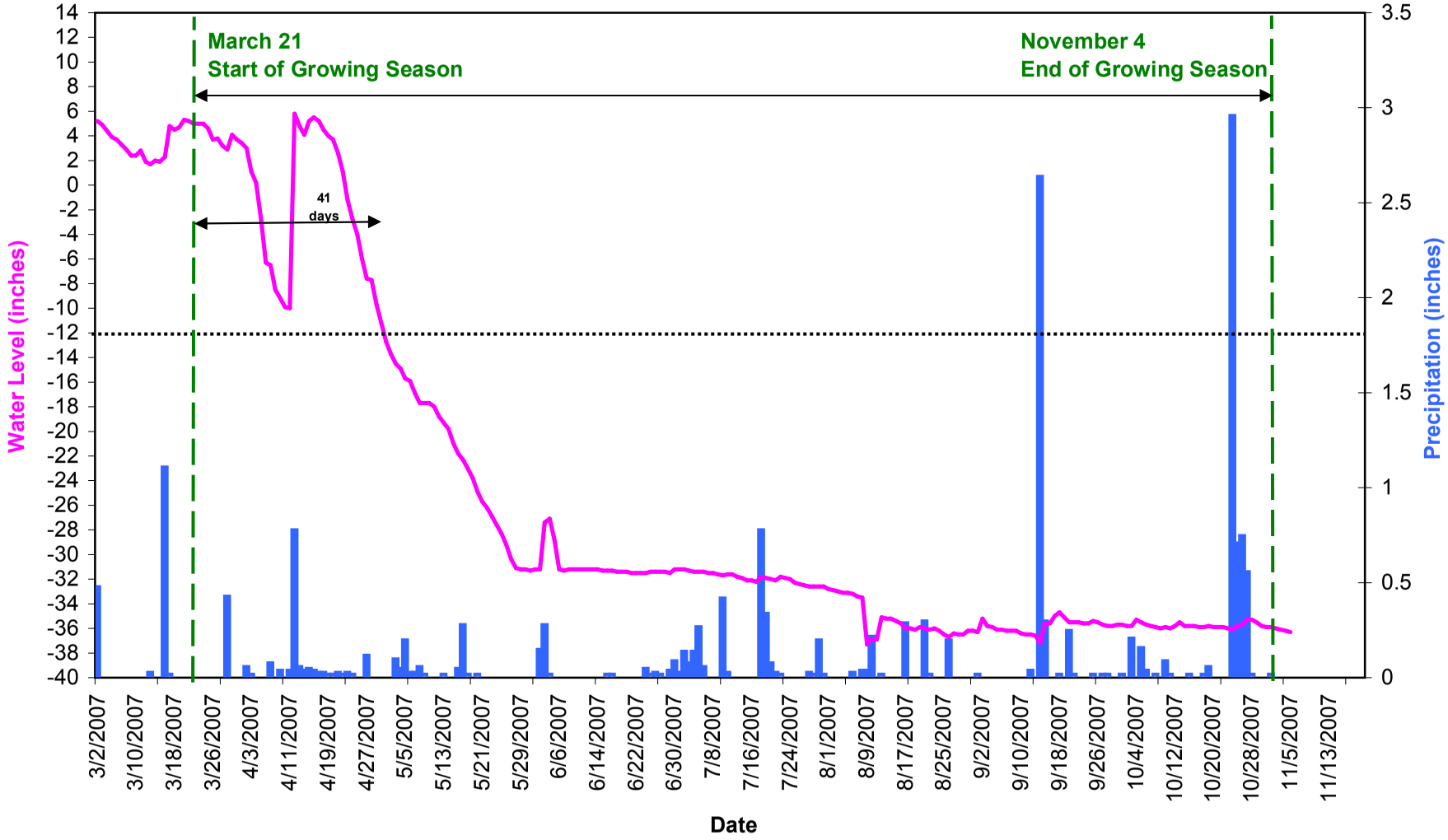
Gauge 9
Howell Woods Year 6 (2007 Gauge Data)



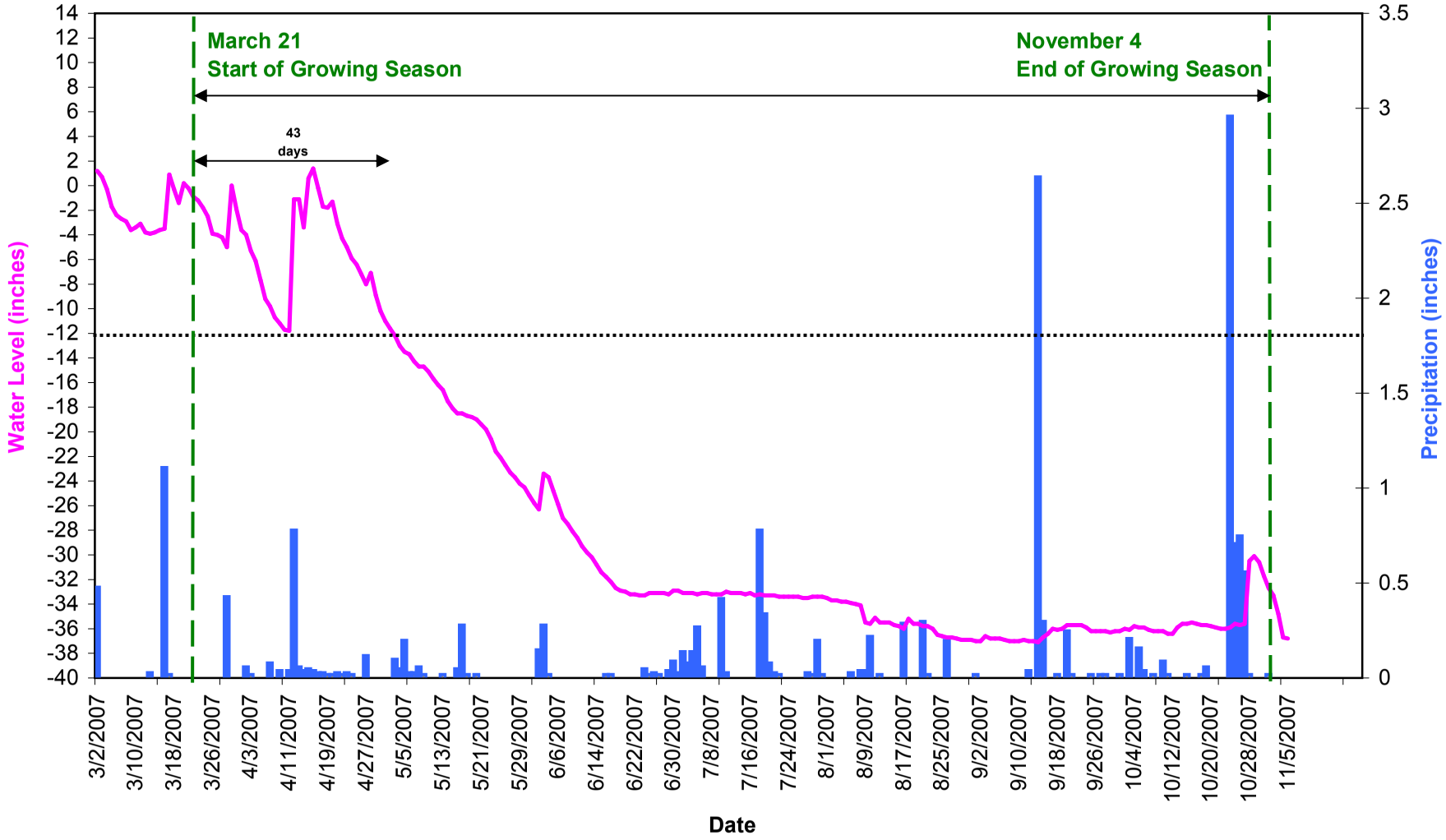
Gauge 10
Howell Woods Year 6 (2007 Gauge Data)



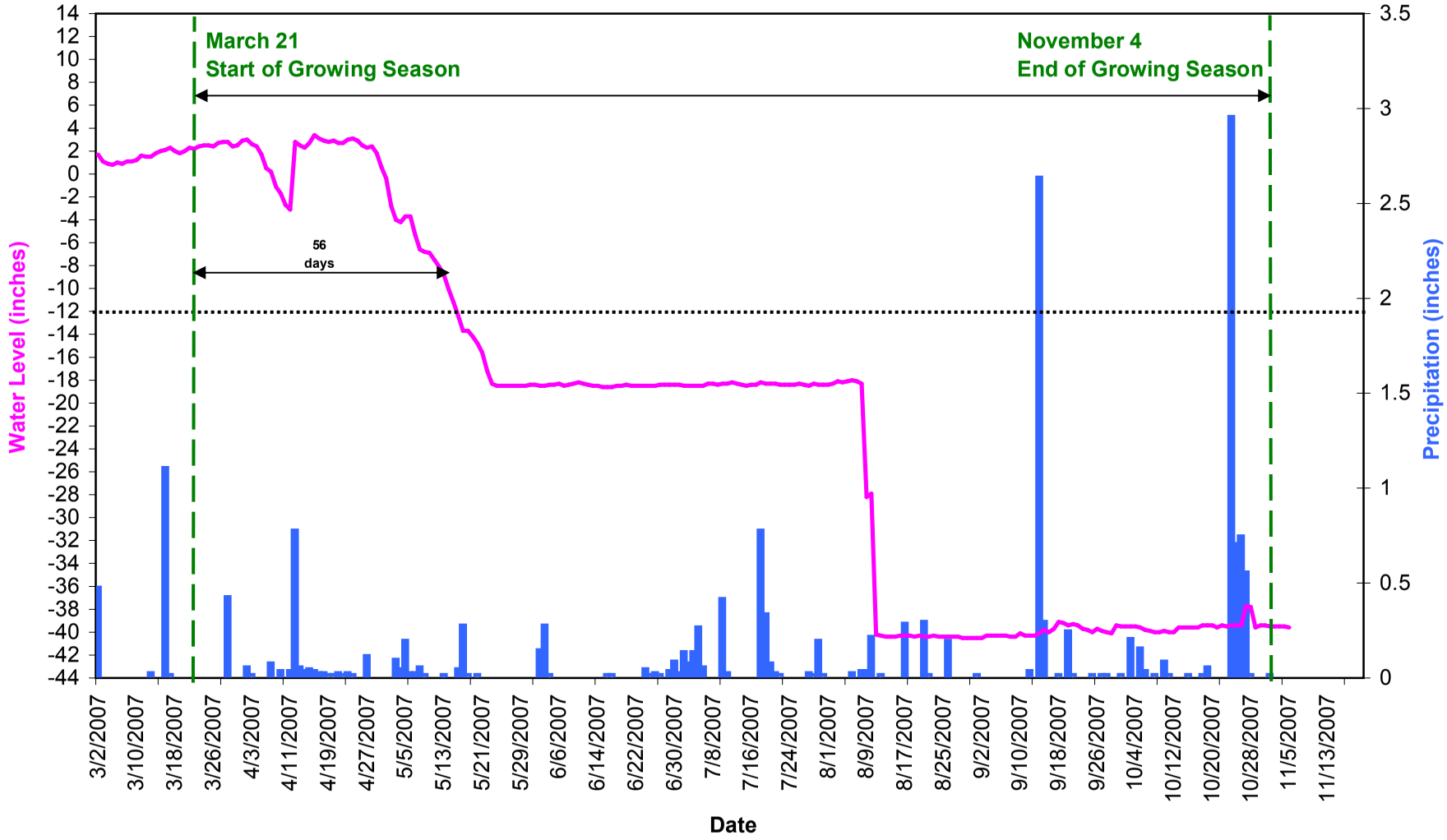
Gauge 11
Howell Woods Year 6 (2007 Gauge Data)



Gauge 12
Howell Woods Year 6 (2007 Gauge Data)



Reference Gauge 1
Howell Woods Year 6 (2007 Gauge Data)



Reference Gauge 2
Howell Woods Year 6 (2007 Gauge Data)