ANNUAL MONITORING REPORT
CHARLES CREEK PARK

WETLAND RESTORATION
PASQUOTANK COUNTY, NORTH CAROLINA
(EEP Project Number 79)

Monitoring Year 2 of 5 (2008)

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

December 2008

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Prepared by:
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2126 Rowland Pond Drive
Willow Spring, North Carolina 27592

Design Firm:
Soil & Environmental Consultants
11010 Raven Ridge Road
Raleigh, North Carolina 27614

Axiom Environmental, Inc.

Ecosystem Enhancement PROGRAM

December 2008

EXECUTIVE SUMMARY

The Charles Creek Park Wetland Restoration Site (Site) is located within the United States Geological Survey Hydrologic Unit 03010205 (North Carolina Division of Water Quality subbasin 03-01-50) of the Pasquotank River Basin. The Site includes 2.13 acres along the southeast bank of Charles Creek near its confluence with the Pasquotank River, located within Charles Creek Park in downtown Elizabeth City, North Carolina in Pasquotank County. A total of 1.93 acres of the Site is comprised of restored and enhanced wetlands, and open water areas. The Site is currently owned by the City of Elizabeth City with the conservation easement owned by the North Carolina Ecosystem Enhancement Program. This report summarizes data for year 2 (2008) monitoring.

The primary goals and objectives of the project included the following.

1. Restore and enhance wetland function, vegetative structure, and wildlife habitat to the Site.
2. Improve the aesthetics of the Site similar to that of surrounding natural cypress-gum swamplands.
3. Retain natural onsite assets such as large existing bald cypress trees.
4. Incorporate the Site into Elizabeth City in such a manner to foster public interests in wetland restoration.

Four vegetation plots (10-meters square) were established and monumented after construction. These plots were surveyed in September 2008 for the year 2 (2008) monitoring season. Based on the number of stems counted, average densities were measured at 738 stems per acre surviving in year 2 (2008). The dominant species identified at the Site were planted stems of bald cypress (*Taxodium distichum*), swamp blackgum (*Nyssa aquatica*), and swamp titi (*Cyrilla racemiflora*). In addition, each individual vegetation plot met success criteria.

Four groundwater monitoring gauges and one rain gauge have been maintained and monitored throughout the year 2 (2008) growing season. Success criteria for wetland groundwater hydrology at the Site require inundation or saturation within 12 inches of the ground surface for a consecutive period of 8.5 percent of the growing season or approximately 18 consecutive days. Groundwater hydrology within 12 inches of the soil surface occurred for greater than 8.5 percent of the growing season and groundwater hydrology was successful for the year 2 (2008) growing season.

No problem areas have been identified during the year 2 (2008) monitoring year. In summary, the Site is stable, and vegetation and groundwater hydrology at the Site were successful.

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1.0 PROJECT BACKGROUND

1.1 Location and Setting

The Charles Creek Park Wetland Restoration Site (Site) is located within the United States Geological Survey (USGS) Hydrologic Unit 03010205 (North Carolina Division of Water Quality [NCDWQ] subbasin 03-01-50) of the Pasquotank River Basin. The Site includes 2.13 acres along the southeast bank of Charles Creek near its confluence with the Pasquotank River, located within Charles Creek Park in downtown Elizabeth City, North Carolina in Pasquotank County (Figure 1). A total of 1.93 acres of the Site is comprised of restored and enhanced wetlands, and open water areas.

The Site is located in a property owned by Elizabeth City, in an urban residential area comprised of single family homes. The North Carolina Ecosystem Enhancement Program (NCEEP) owns a conservation easement on the property. The Site is bordered by a paved basketball court and Southern Avenue to the west, Dawson Street to the south, Hunter Street to the east, and Tuscarora Avenue and Charles Creek to the north.

Directions to the Site:
From Elizabeth City:

- Travel east on Highway 17, take Business 17 (Ehringhaus St.) into downtown Elizabeth City and travel approximately 1.5 miles
- Turn right onto Southern Avenue and travel approximately 0.4 mile
- Turn left on Dawson Street
- The Site is on the left and is bordered by a paved basketball court and Southern Avenue to the west, Dawson Street to the south, Hunter Street to the east, and Tuscarora Avenue and Charles Creek to the north.

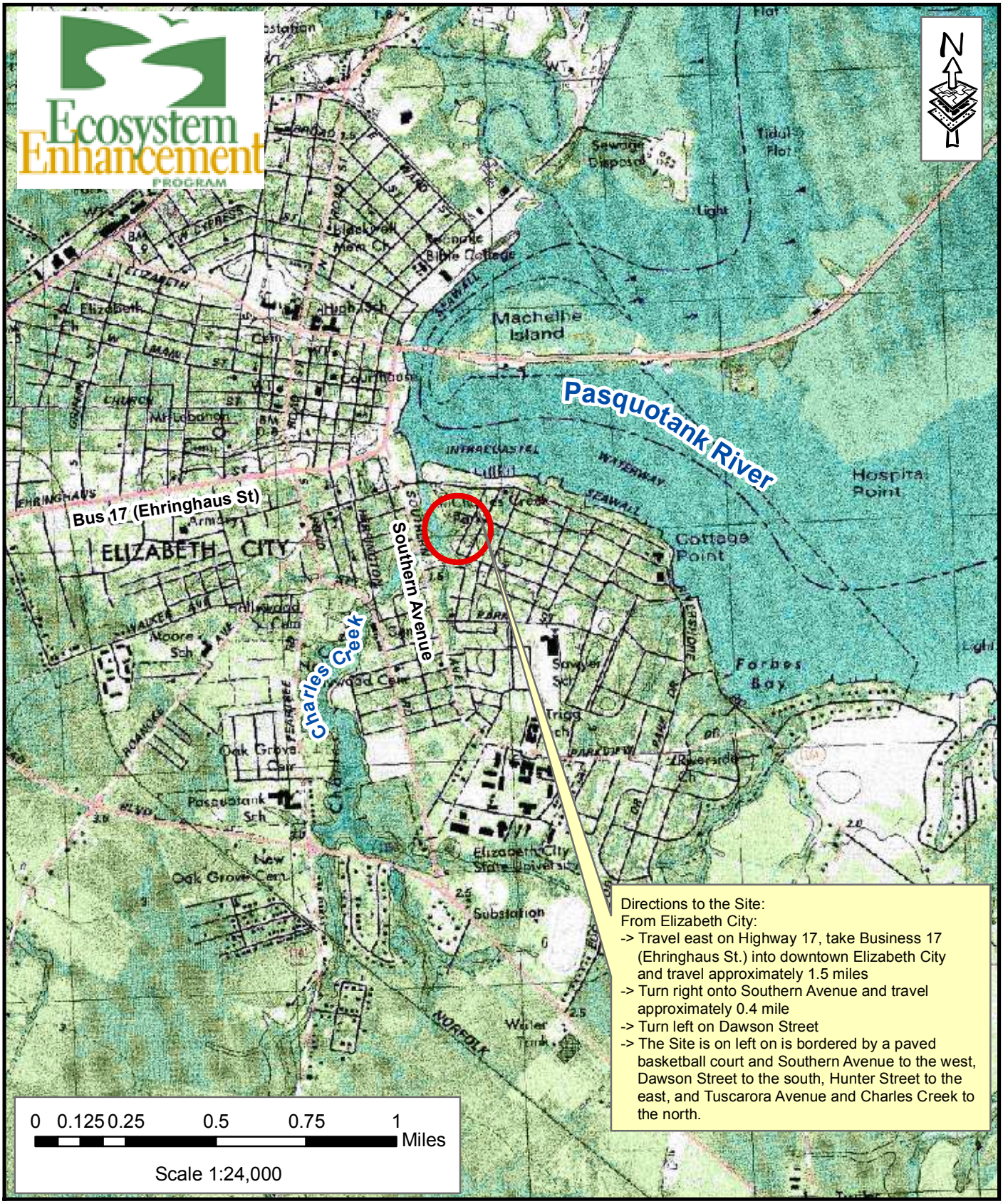
1.2 Project Objectives

The specific goals and objects of the Charles Creek Park Wetland Restoration as described in the March 2005 Restoration Plan are as follows.

1. Restore and enhance wetland function, vegetative structure, and wildlife habitat within approximately 1.93 acres of lower coastal plain bald cypress-gum swamp.
2. Incorporate the restoration effort into the surrounding areas in an aesthetically pleasing manner that doesn't significantly depart from the surrounding nearby cypress-gum swamplands.
3. Retain valuable natural onsite assets (i.e. large existing bald cypress trees) and incorporate them into the Site restoration plan.
4. Incorporate the Site into the community of Elizabeth City in a manner conducive to fostering public interest in wetland restoration.

1.3 Project Structure, Restoration Type, and Approach

Prior to implementation of wetland restoration activities, the Site was filled to create a city park with most of the usable surface maintained as turf grass for recreational purposes with a few remnant areas of cypress gum swam remaining adjacent to Charles Creek and two unnamed tributaries within the Site. Natural areas within the Site contained many large bald cypress trees. Restoration efforts at the Site entailed 1) removal of fill material, 2) grading the Site to historic elevations to restore wetland hydrology, and 3) planting the Site. Project structures and objectives are summarized in Table 1.



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

SITE LOCATION
CHARLES CREEK PARK RESTORATION SITE
EEP Project Number 79
Pasquotank County, North Carolina

Dwn. by.	FIGURE
CLF	1
Date: Oct 2008	
Project: 08-001	

Table 1. Project Restoration Components

Charles Creek Park Wetland Restoration (EEP Project Number 79)

Project Segment or Reach ID	Existing Acreage	Mitigation Type	Approach	Acreage	Mitigation Ratio	Mitigation Units	Stationing	Comment
Restoration	1.16	Restoration	--	1.16	1	1.16	--	--
Enhancement	0.60	Enhancement	--	0.60	2	0.30	--	--
Open Water	0.17	Preservation	--	0.17	5	0.03	--	--

Mitigation Unit Summations

Stream	Riparian Wetland	Nonriparian Wetland	Total Wetland	Buffer	Comment
0	1.49	0	1.49	0	--

1.4 Project History and Background

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

Table 2. Project Activity and Reporting History

Charles Creek Park Wetland Restoration (EEP Project Number 79)

Activity or Report	Data Collection Completion	Actual Completion or Delivery
Restoration Plan	---	March 2005
Construction	---	July 2006
Planting/Permanent Seed Mix Applied	---	July 2006
Mitigation Plan/As-built Report (Year 0 Monitoring – baseline)	---	March 2007
Year 1 Monitoring (2007)	November 2007	December 2007
Year 2 Monitoring (2008)	November 2008	December 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 Contacts Table

Charles Creek Park Wetland Restoration (EEP Project Number 79)

Designer and Year 1 (2007) Monitoring Performers	Soil & Environmental Consultants, PA 11010 Raven Ridge Rd. Raleigh, NC 27614 Patrick K. Smith (919) 846-5900
Construction Contractor	North State Environmental, Inc. 2889 Lowery St. Winston-Salem, NC 27101 Darrell Westmoreland (336) 725-2010
Construction, Planting, and Seeding Contractor	Trader Construction Company 2500 Highway 70 East New Bern, North Carolina 28560 Carl Huddle (252) 633-2424
Year 2 (2008) Monitoring Performers	Axiom Environmental, Inc. 2126 Rowland Pond Dr. Willow Spring, NC 27592 Grant Lewis (919) 215-1693

Table 4. Project Background Table

Charles Creek Park Wetland Restoration (EEP Project Number 79)

Project County	Pasquotank County, North Carolina
Drainage Area	21.3 acres
Drainage impervious cover estimate (%)	< 20 percent
Stream Order	Not Applicable
Physiographic Region	Coastal Plain
Ecoregion	Middle Atlantic Coastal Plain
Rosgen Classification of As-built	Not Applicable
Cowardin Classification	Estaurine
Dominant Soil Types	Mattapex, Bibb, "Swamp"
Reference Site ID	Charles Creek
USGS HUC for Project and Reference	03010205
NCDWQ Subbasin for Project and Reference	03-01-50
NCDWQ Classification for Project and Reference	C Sw
Any portion of any project segment 303d listed?	No
Any portion of any project segment upstream of a 303d listed segment?	No
Reasons for 303d listing or stressor	Not Applicable
% of project easement fenced	None

1.5 Monitoring Plan View
Monitoring activities for the Site, including relevant structures and utilities, project features, specific project structures, and monitoring features are detailed on Sheet 1 (Monitoring Plan View) in Appendix C.

2.0 PROJECT CONDITION AND MONITORING RESULTS

2.1 Vegetation Assessment
Four vegetation plots were established and marked after construction with a groundwater gauge at one corner and PVC at the remaining corners as depicted on Sheet 1 (Monitoring Plan View) in Appendix C. The plots are 10 meters square and are located randomly within the Site. These plots were surveyed in September 2008 for the 2008 (year 2) monitoring season using the *CVS-EEP Protocol for Recording Vegetation, Version 4.0* (Lee et al. 2006) (http://cvs.bio.unc.edu/methods.htm); results are included in Appendix A. The taxonomic standard for vegetation used for this document was *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas* (Weakley 2007).

Vegetation success criteria dictates that an average density of 320 stems per acre must be surviving in the first three monitoring years. Subsequently, 290 stems per acre must be surviving in year 4 and 260 stems per acre in year 5. Stem counts will be based on an average of the evaluated vegetation plots.

Based on the number of stems counted, average densities were measured at 738 stems per acre surviving in year 2 (2008). The dominant species identified at the Site were planted stems of bald cypress (*Taxodium distichum*), swamp blackgum (*Nyssa aquatica*), and swamp titi (*Cyrilla racemiflora*). In addition, each individual vegetation plot met success criteria. No vegetation problem areas were present within the Site during year 2 (2008) monitoring.

2.2 Wetland Assessment
Four groundwater monitoring gauges and one rain gauge have been maintained and monitored throughout the year 2 (2008) growing season. The graphs of groundwater hydrology and precipitation are included in Appendix B.

The growing season in Pasquotank County begins April 7 and ends November 1 (209 days). Success criteria for wetland groundwater hydrology at the Site require inundation or saturation within 12 inches of the ground surface for a consecutive period of 8.5 percent of the growing season or approximately 18 consecutive days. This duration has been selected as the mean desired percentage; however, an individual gauge will be deemed successful if it falls within the range of 5 to 12 percent of the growing season or approximately 10 to 26 days.

Cypress swamps are palustrine systems that are seasonally to semipermanantly flooded. The adjacent blackwater rivers that provide hydrology to these swamps tend to have highly variable flow regimes, with floods of short duration and periods of low flow. The water tends to be acidic with low levels of mineral sediments and nutrients, and is colored by tannins but is relatively clear (Schafale and Weakley 1990).

Groundwater hydrology within 12 inches of the soil surface occurred for greater than 8.5 percent of the growing season and groundwater hydrology was successful for the year 2 (2008) growing season.

2.2.1 Wetland Current Condition Plan View
No wetland problem areas have been identified during the year 2 (2008) monitoring year (Sheet 2 [Current Condition Plan View] in Appendix C).

2.2.2 Wetland Criteria Attainment

All monitored gauges within restoration areas were inundated/saturated within 12 inches of the surface for greater than 8.5 percent of the growing season with sufficient flooding to support cypress-gum swamp vegetation (Table 5). Hydrographs containing precipitation data for each gauge can be found in Appendix B. Photographs within the Site can be found in Appendix A.

Table 5. Wetland Criteria Attainment for Year 2 (2008)

Charles Creek Park Wetland Restoration (EEP Project Number 79)

Gauge ID	Hydrology Threshold Met?	Consecutive Days Saturated (% of Growing Season)	Hydrophytic Vegetation Criteria Met?	Site Mean	Vegetation Plot ID	Vegetation Survival Threshold Met?	Site Mean
1	Yes	34 days (16.3%)	Yes	100 %	1	Yes	100%
2	Yes	50 days (23.9%)	Yes		2	Yes	
3	Yes	141 days (67.5%)	Yes		3	Yes	
4	Yes	40 days (19.1%)	Yes		4	Yes	

4.0. REFERENCES

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

Schafale, M. P., A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina: Third Approximation, NC Natural Heritage Program, Division of Parks and Recreation, NC DEM, Raleigh NC.

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

APPENDIX A

VEGETATION DATA

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

Report Prepared By	Corri Faquin
Date Prepared	12/18/2008 13:57
database name	Axiom-2008-B-v2.2.6.mdb
database location	C:\Business\CVS database
computer name	AXIOM-0A9116A70
file size	47788032

DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------

Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.

PROJECT SUMMARY----------

Project Code	10561201
project Name	Charles Creek
Description	Wetland Mitigation Site
River Basin	Pasquotank
length(ft)	
stream-to-edge width (ft)	
area (sq m)	7810
Required Plots (calculated)	3
Sampled Plots	4

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

Project Code	Project Name	River Basin	Year 2
010561201	Charles Creek	Pasquotank	738.55

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

Project Code	Project Name	River Basin	Year 2
010561201	Charles Creek	Pasquotank	2316.83

Plot Information

plot	Plot Level	Year	Date Sampled	Planted Living Stems	Planted Living Stems EXCLUDING Live Stakes	Dead/ Missing Stems	Natural (Volunteer) Stems	Total Living Stems	Total Living Stems EXCLUDING Live Stakes	Planted Living Stems per ACRE	Planted Living Stems EXCLUDING Live Stakes PER ACRE	Natural (Volunteer) Stems PER ACRE	Total Living Stems PER ACRE	Total Living Stems EXCLUDING Live Stakes PER ACRE	# species
010561201-AXE-0001-year:2	2	2	9/10/2008	17	17	0	99	116	116	688	688	4006	4694	4694	10
010561201-AXE-0002-year:2	2	2	9/10/2008	13	13	0	48	61	61	526	526	1942	2469	2469	8
010561201-AXE-0003-year:2	2	2	9/10/2008	8	8	0	2	10	10	324	324	81	405	405	4
010561201-AXE-0004-year:2	2	2	9/10/2008	35	35	0	7	42	42	1416	1416	283	1700	1700	14

Vigor

vigor	Count	Percent
2	20	27.4
3	22	30.1
4	31	42.5

Damage by Plot

	plot	All Damage Categories	(no damage)
	010561201-AXE-0001-year:2	17	17
	010561201-AXE-0002-year:2	13	13
	010561201-AXE-0003-year:2	8	8
	010561201-AXE-0004-year:2	35	35
TOT:	**4**	**73**	**73**

Damage

Damage	Count	Percent Of Stems
(no damage)	73	100

Vigor by Species

	Species	4	3	2	1	0	Missing	Unknown
	Cephalanthus occidentalis	1	3					
	Clethra alnifolia	1	4					
	Cornus amomum	1	1	4				
	Cyrilla racemiflora	2	5	1				
	Fraxinus pennsylvanica	5						
	Lyonia lucida			1				
	Nyssa aquatica	3	1	3				
	Nyssa biflora		1	1				
	Persea palustris	3	1	1				
	Taxodium distichum	9	1	1				
	Viburnum nudum	3	1					
	Viburnum dentatum		1	4				
	Lyonia		1					
	Magnolia virginiana		2					
	Nyssa	3						
	Unknown			4				
TOT:	**16**	**31**	**22**	**20**				

Damage by Species

	Species	All Damage Categories	(no damage)
	Cephalanthus occidentalis	4	4
	Clethra alnifolia	5	5
	Cornus amomum	6	6
	Cyrilla racemiflora	8	8
	Fraxinus pennsylvanica	5	5
	Lyonia	1	1
	Lyonia lucida	1	1
	Magnolia virginiana	2	2
	Nyssa	3	3
	Nyssa aquatica	7	7
	Nyssa biflora	2	2
	Persea palustris	5	5
	Taxodium distichum	11	11
	Unknown	4	4
	Viburnum dentatum	5	5
	Viburnum nudum	4	4
TOT:	**16**	**73**	**73**

Planted Stems by Plot and Species

	Species	Total Planted Stems	# plots	avg# stems	plot 010561201-AXE-0001-year:2	plot 010561201-AXE-0002-year:2	plot 010561201-AXE-0003-year:2	plot 010561201-AXE-0004-year:2
	Cephalanthus occidentalis	4	2	2	2			2
	Clethra alnifolia	5	3	1.67	1	1		3
	Cornus amomum	6	2	3		2		4
	Cyrilla racemiflora	8	4	2	2	1	1	4
	Fraxinus pennsylvanica	5	3	1.67	2	1		2
	Lyonia	1	1	1				1
	Lyonia lucida	1	1	1	1			
	Magnolia virginiana	2	1	2				2
	Nyssa	3	1	3				3
	Nyssa aquatica	7	3	2.33		3	3	1
	Nyssa biflora	2	1	2	2			
	Persea palustris	5	3	1.67	2	1		2
	Taxodium distichum	11	4	2.75	1	3	3	4
	Unknown	4	2	2	1			3
	Viburnum dentatum	5	3	1.67	3	1		1
	Viburnum nudum	4	2	2			1	3
TOT:	**16**	**73**	**16**		**17**	**13**	**8**	**35**

All Stems by Plot and Species

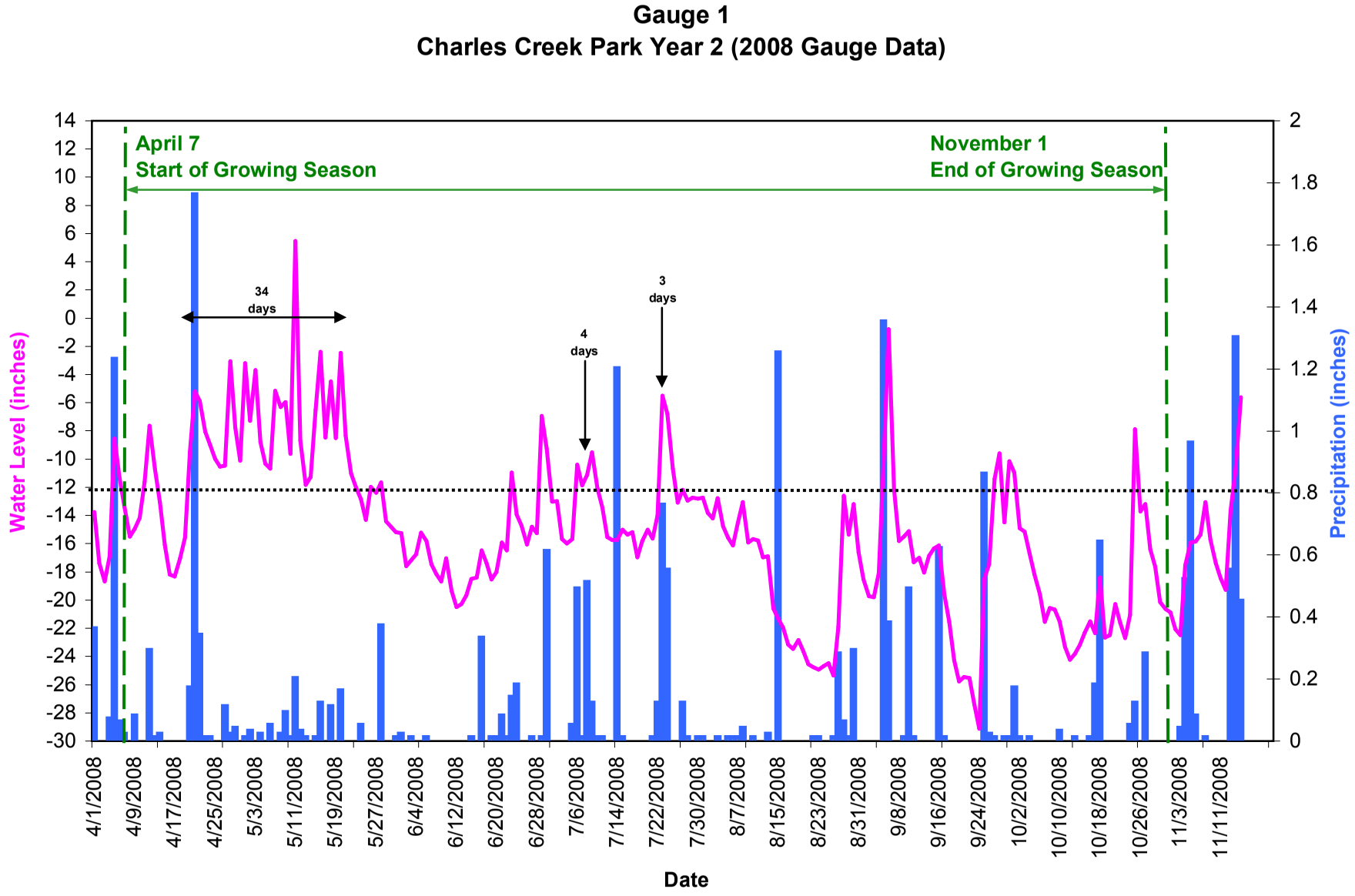
	Species	Total Stems	# plots	avg# stems	010561201-AXE-0001-year:2	010561201-AXE-0002-year:2	010561201-AXE-0003-year:2	010561201-AXE-0004-year:2
	Baccharis halimifolia	107	4	26.75	94	8	1	4
	Carya illinoinensis	2	1	2		2		
	Cephalanthus occidentalis	5	3	1.67	2	1		2
	Clethra alnifolia	5	3	1.67	1	1		3
	Cornus amomum	6	2	3		2		4
	Cyrilla racemiflora	8	4	2	2	1	1	4
	Fraxinus pennsylvanica	5	3	1.67	2	1		2
	Ligustrum sinense	4	1	4		4		
	Lyonia lucida	1	1	1	1			
	Nyssa aquatica	7	3	2.33		3	3	1
	Nyssa biflora	2	1	2	2			
	Persea palustris	5	3	1.67	2	1		2
	Pinus taeda	2	1	2	2			
	Sambucus canadensis	1	1	1		1		
	Taxodium distichum	16	4	4	1	4	4	7
	Viburnum nudum	4	2	2			1	3
	Morella cerifera	18	2	9	3	15		
	Viburnum dentatum	6	3	2	3	2		1
	Juniperus virginiana	1	1	1		1		
	Lyonia	1	1	1				1
	Carya	2	1	2		2		
	Magnolia virginiana	2	1	2				2
	Nyssa	4	2	2		1		3
	Prunus serotina	2	1	2		2		
	Acer rubrum	1	1	1		1		
	Ulmus	8	1	8		8		
	Unknown	4	2	2	1			3
TOT:	**27**	**229**	**27**		**116**	**61**	**10**	**42**

Vegetation Monitoring Photographs
Taken December 5, 2008

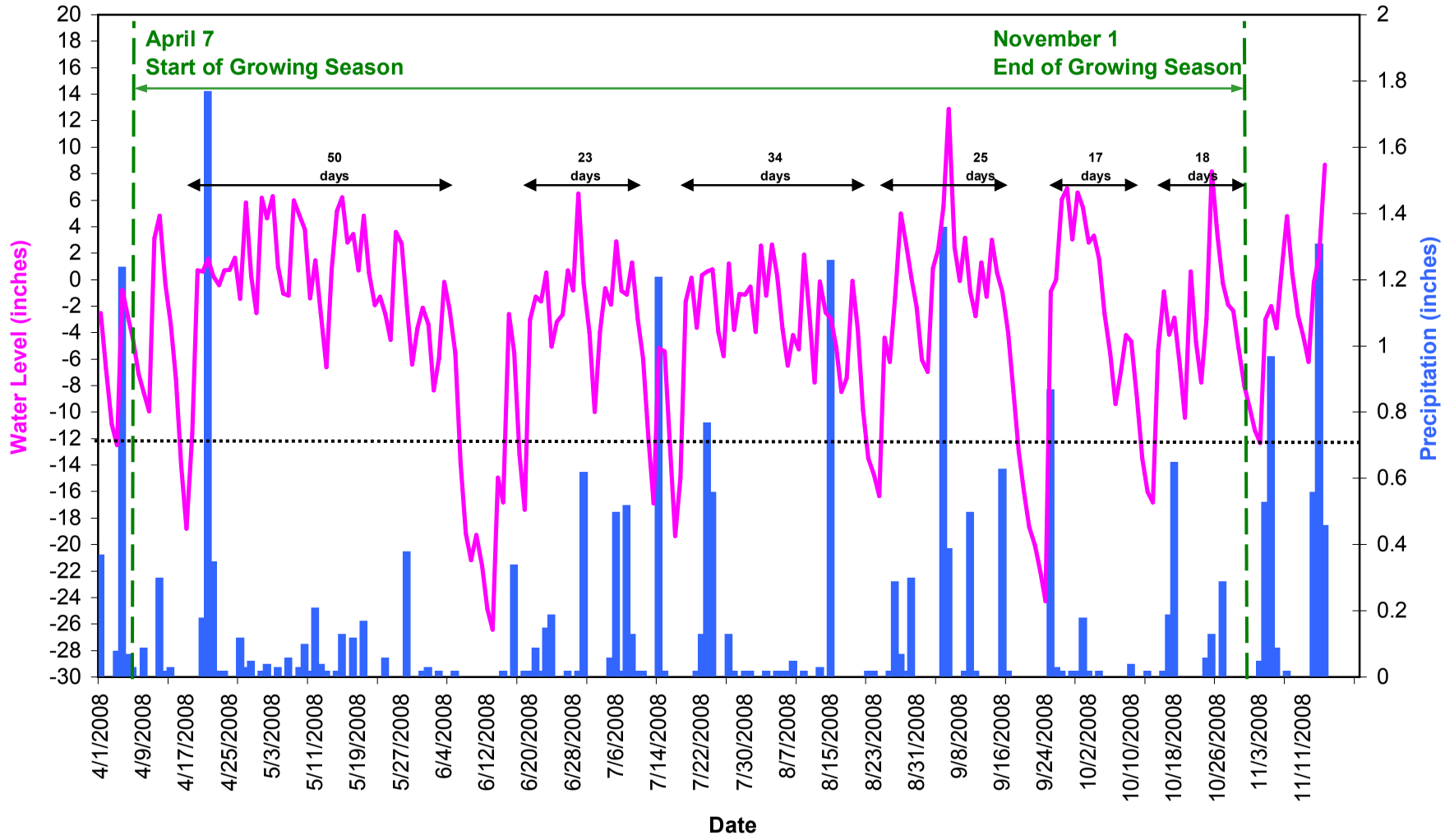
APPENDIX B

HYDROLOGY DATA

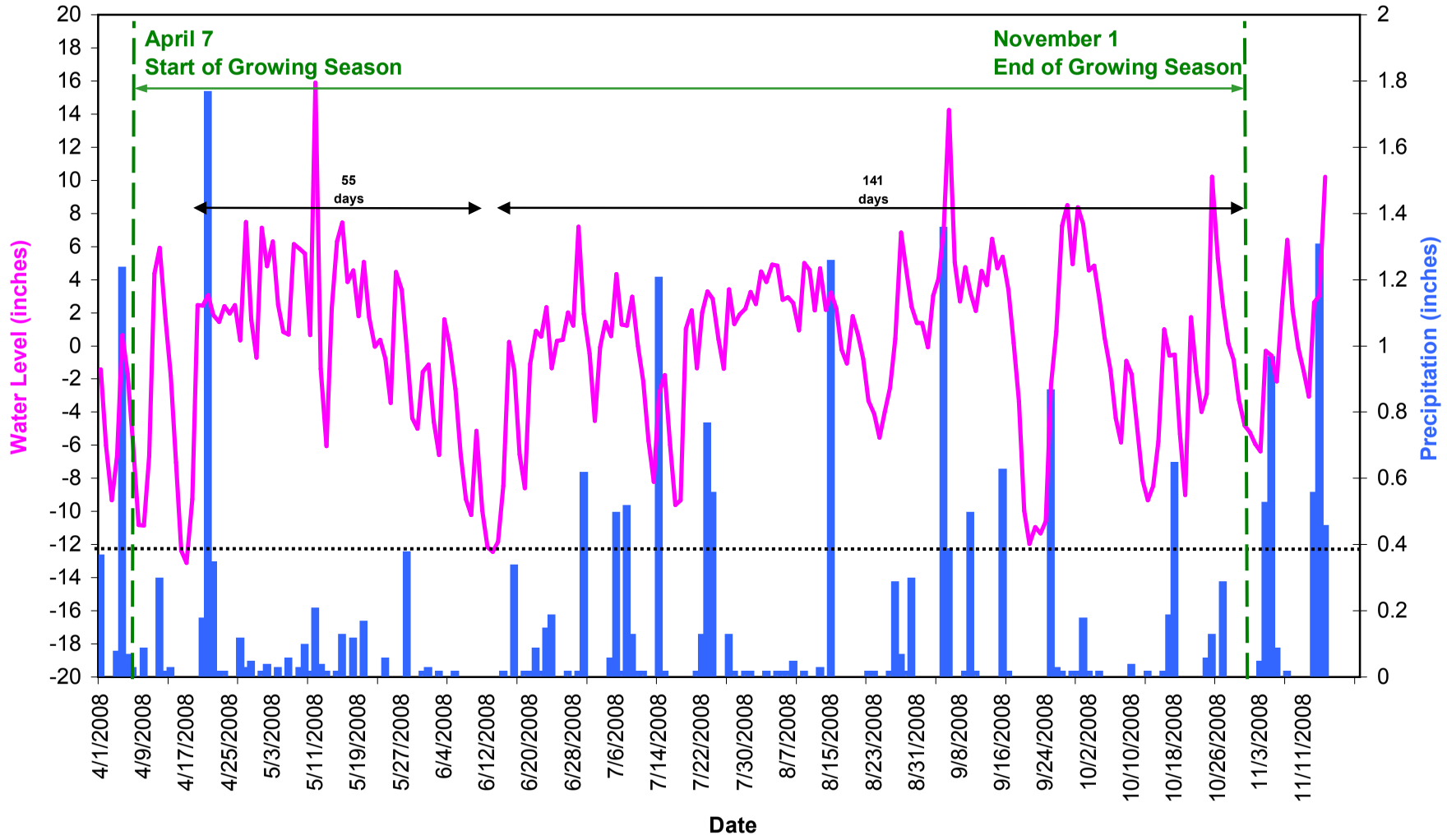
1. 2008 Groundwater Gauge Graphs
2. 2007 Groundwater Gauge Graphs


Gauge 1
Charles Creek Park Year 2 (2008 Gauge Data)
April 7
Start of Growing Season
November 1
End of Growing Season
34
days
4
days
3
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
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
4/1/2008
4/9/2008
4/17/2008
4/25/2008
5/3/2008
5/11/2008
5/19/2008
5/27/2008
6/4/2008
6/12/2008
6/20/2008
6/28/2008
7/6/2008
7/14/2008
7/22/2008
7/30/2008
8/7/2008
8/15/2008
8/23/2008
8/31/2008
9/8/2008
9/16/2008
9/24/2008
10/2/2008
10/10/2008
10/18/2008
10/26/2008
11/3/2008
11/11/2008

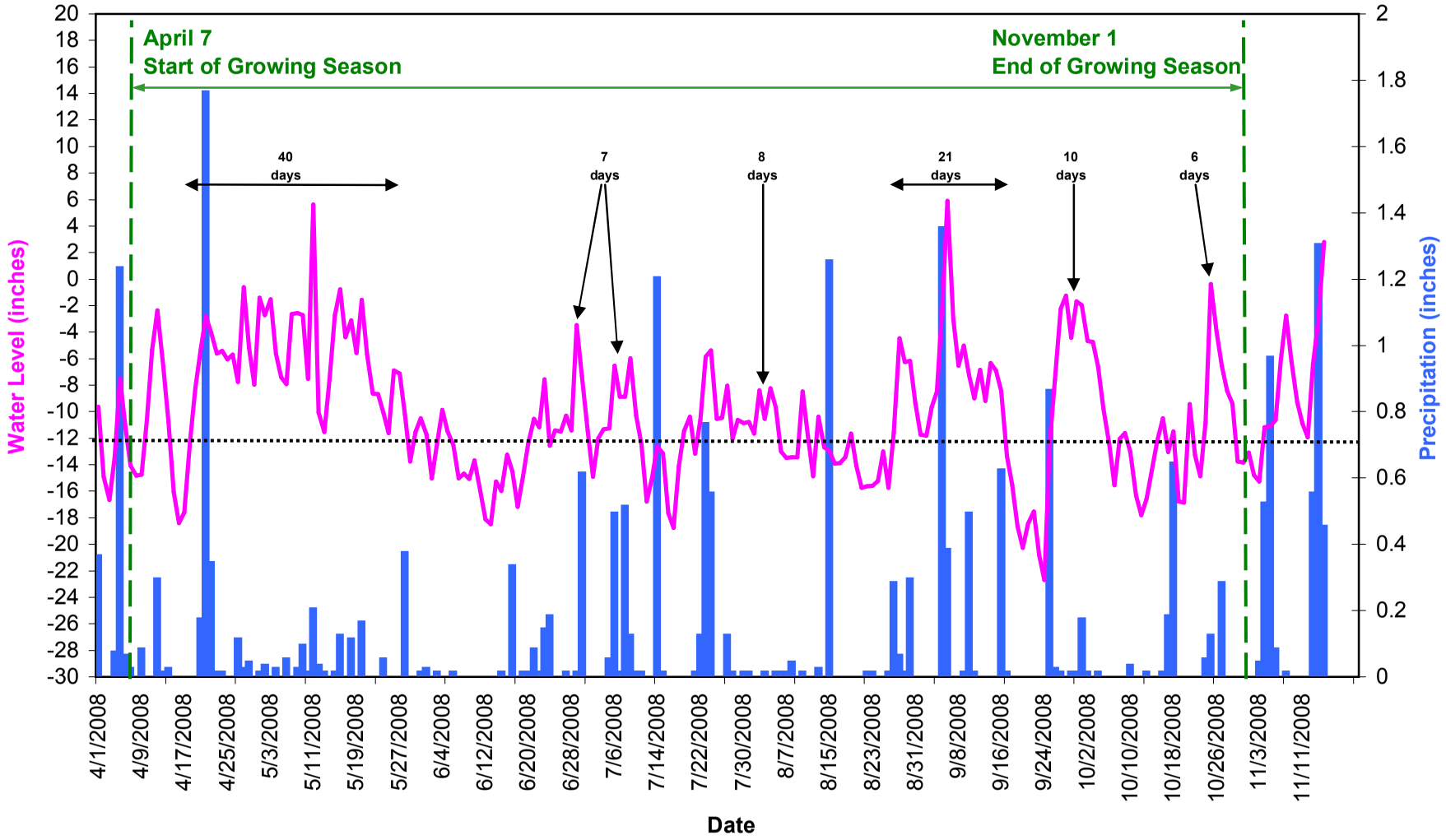
Gauge 2
Charles Creek Park Year 2 (2008 Gauge Data)



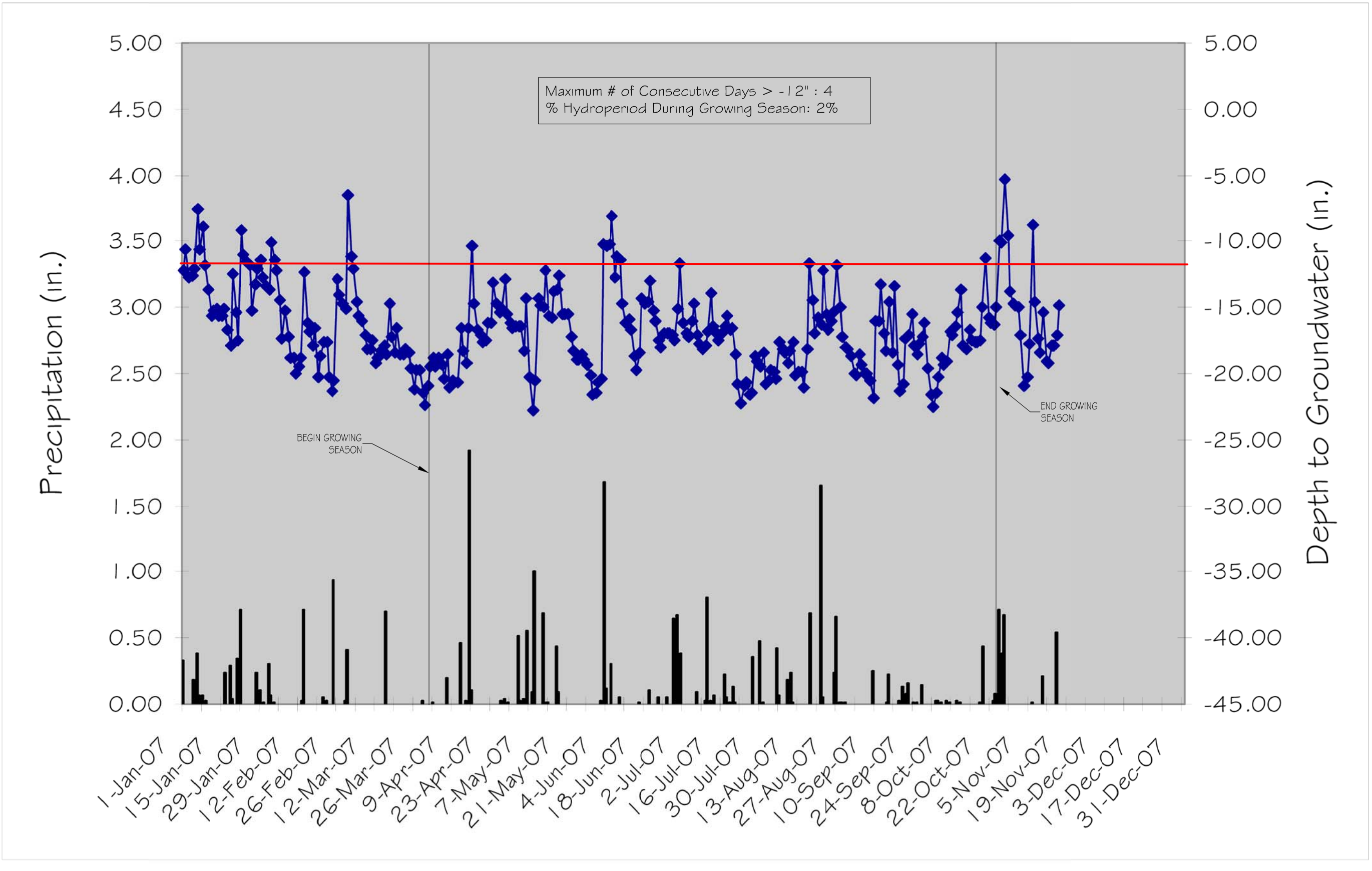
Gauge 3
Charles Creek Park Year 2 (2008 Gauge Data)



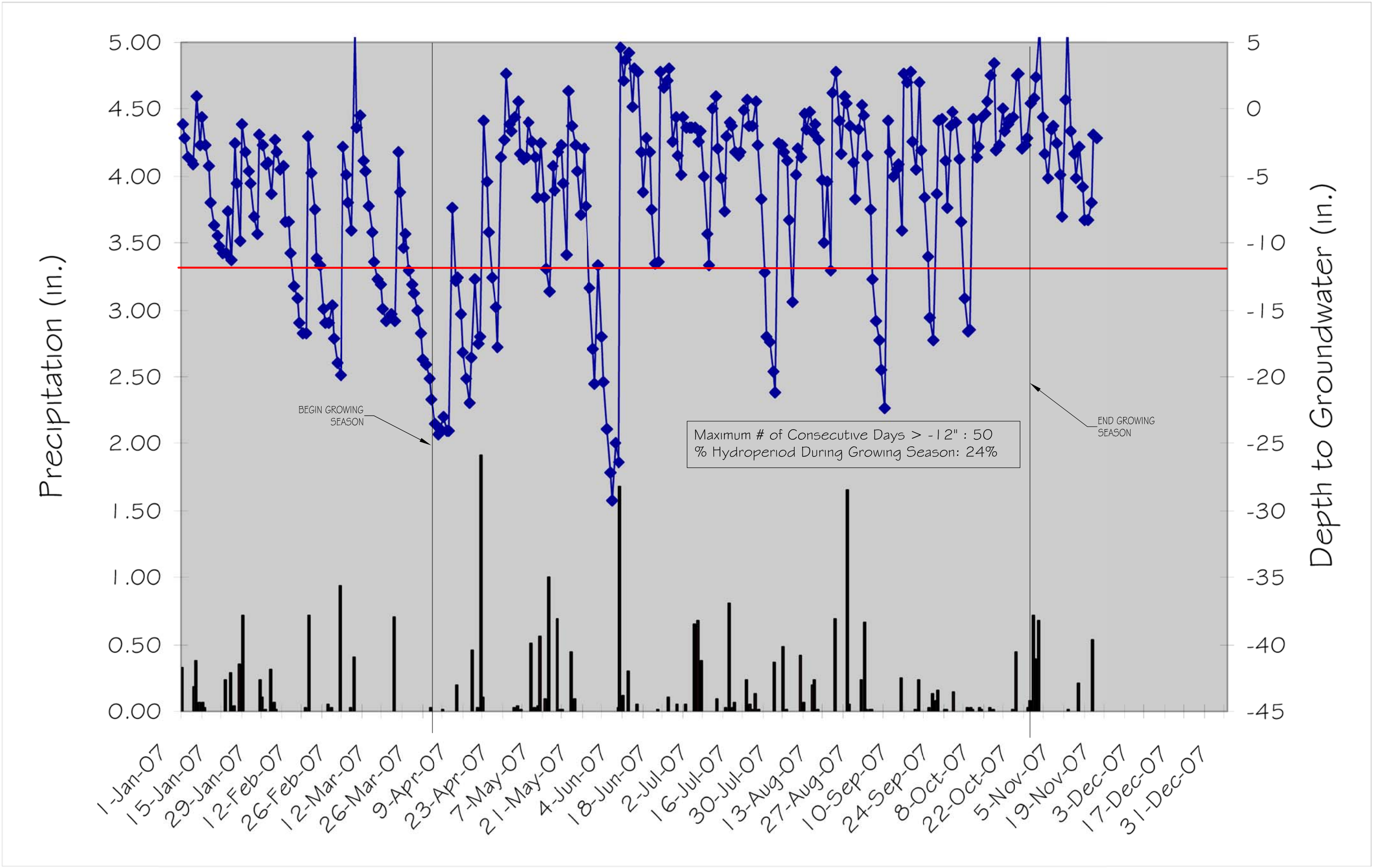
Gauge 4
Charles Creek Park Year 2 (2008 Gauge Data)



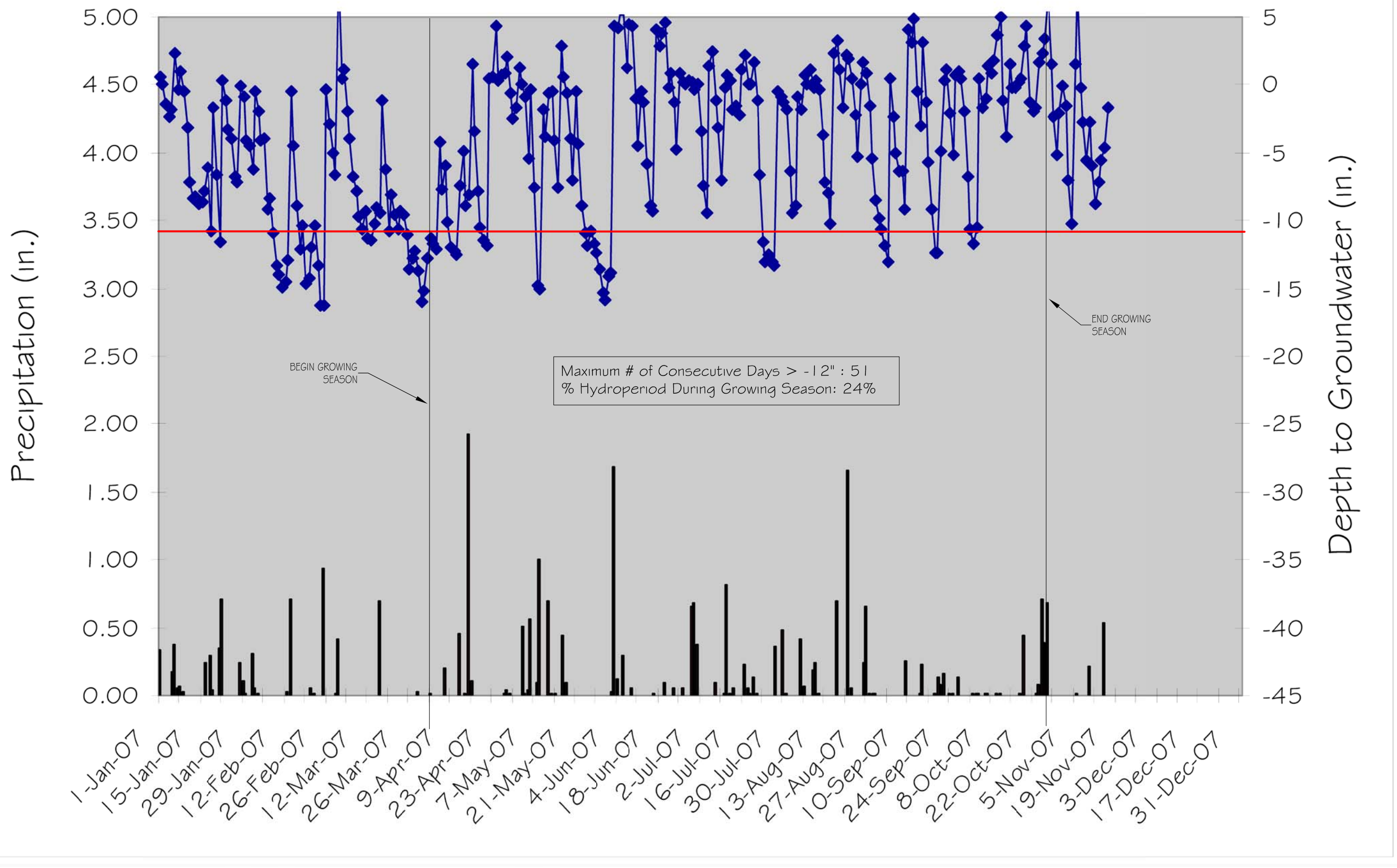
Charles Creek Park Wetland Restoration Site
Groundwater Gauge CCP1



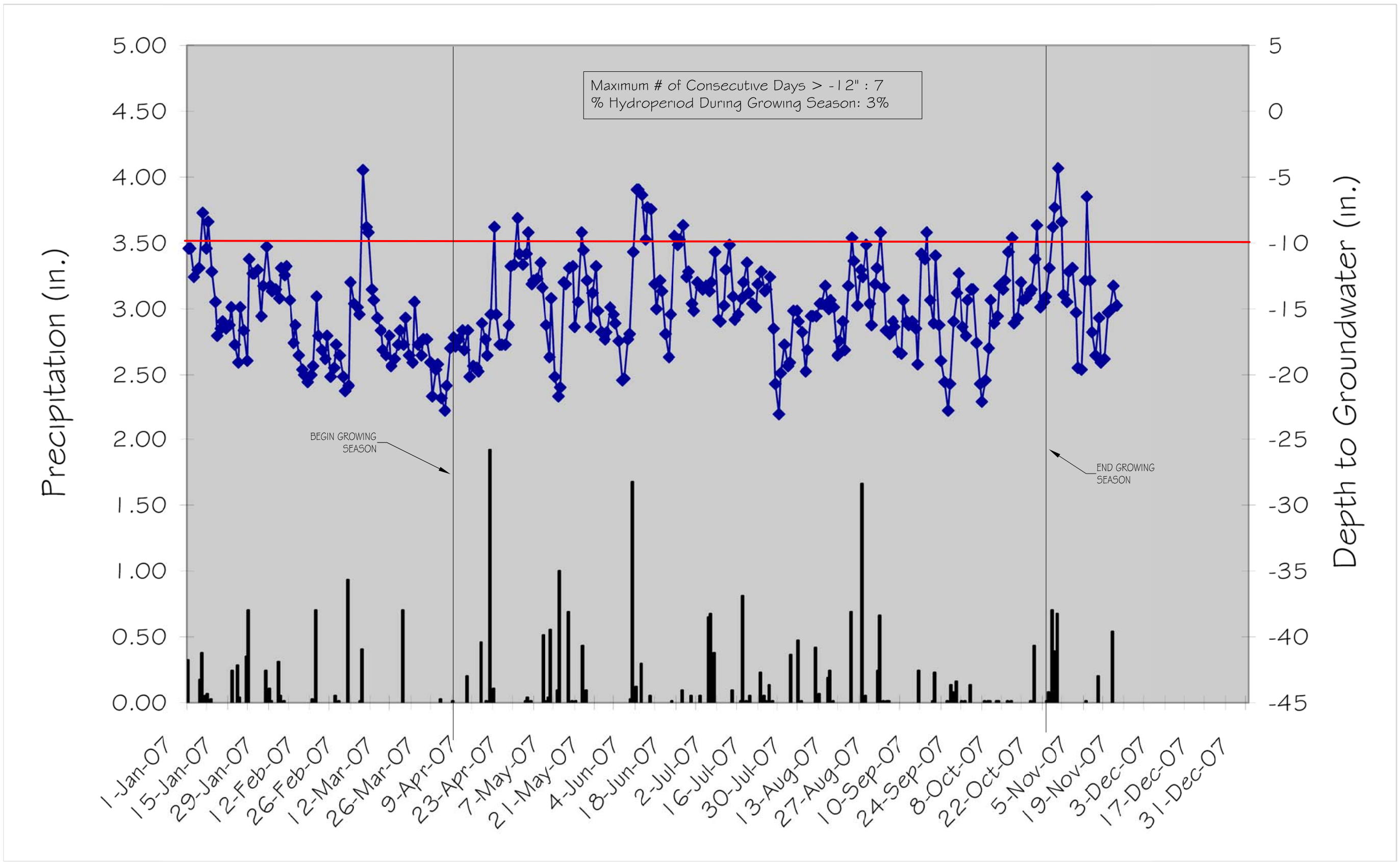
Charles Creek Park Wetland Restoration Site
Groundwater Gauge CCP2



Charles Creek Park Wetland Restoration Site
Groundwater Gauge CCP3



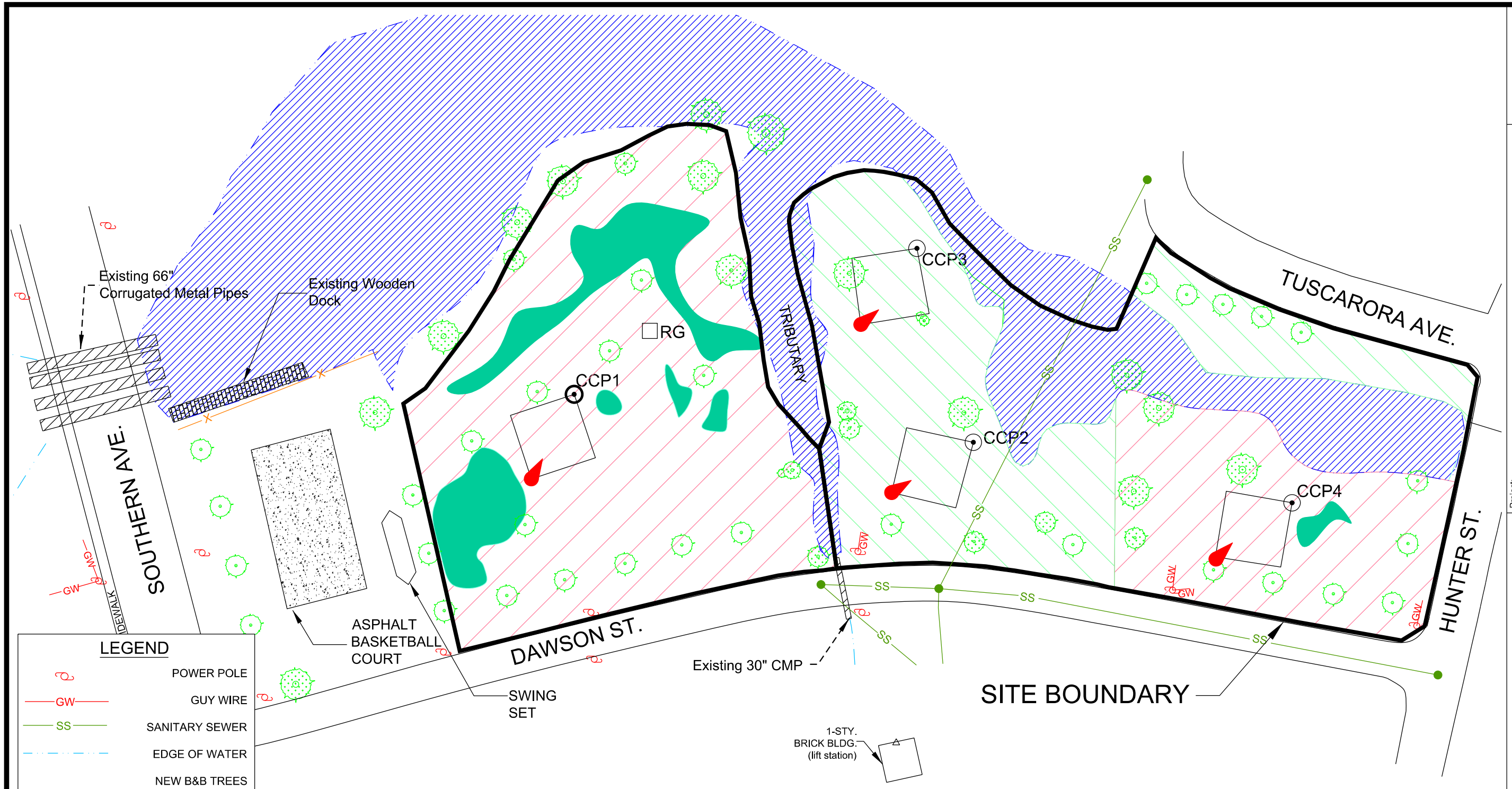
Charles Creek Park Wetland Restoration Site
Groundwater Gauge CCP4



APPENDIX C

PLAN VIEWS

1. Monitoring Plan View
2. Current Condition Plan View



NOTES:

1) SITE FEATURES SHOWN WERE FIELD IDENTIFIED BY LIMITED ENGINEERING SURVEY USING TOTAL STATION EQUIPMENT PERFORMED ON AUGUST 9, 2006.

2) THE LOCATION OF SITE FEATURES IS APPROXIMATE.

SCALE

50 25 0 50

MONITORING PLAN VIEW

File: Sec/Jobs/7-9k/7281.02/Monitoring Data\Drawings\Year 1 - 2007.dwg

Project No.: 7281.D2
Designed: JMO, PKS
Drawn: NMM
Scale: 1" = 50'
Sheet No.: 1 OF 2

Project: CHARLES CREEK PARK WETLAND RESTORATION
Location: PASQUOTANK CO., NC
Client: NORTH CAROLINA ECOSYSTEM ENHANCEMENT PROGRAM
Sheet Title: MONITORING PLAN VIEW

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0	Issued for Construction	07-06-04	JMO
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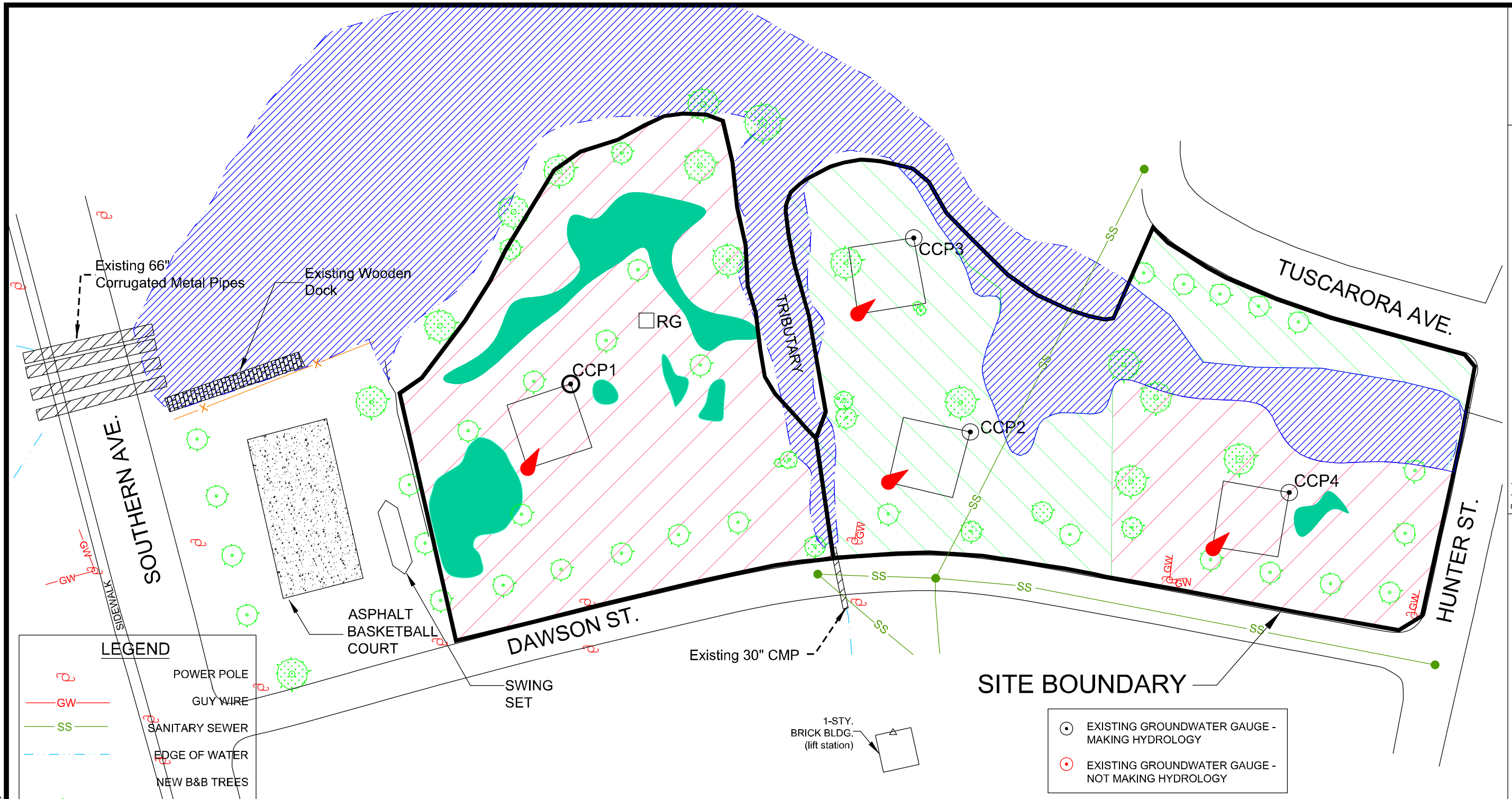

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CURRENT CONDITION PLAN VIEW

Project No.: 7281.D2
Designed: JMO, PKS
Drawn: NMM
Scale: 1" = 50'
Sheet No.: 2 OF 2

Project: CHARLES CREEK PARK WETLAND RESTORATION
Location: PASQUOTANK CO., NC
Client: NORTH CAROLINA ECOSYSTEM ENHANCEMENT PROGRAM
Sheet Title: CURRENT CONDITION PLAN VIEW

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