FINAL
ANNUAL MONITORING REPORT
CHARLES CREEK PARK

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

Monitoring Year 5 of 5 (2011)

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

November 2011

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Prepared by:
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218 Snow Avenue
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Design Firm:
Soil & Environmental Consultants
11010 Raven Ridge Road
Raleigh, North Carolina 27614

Axiom Environmental, Inc.

Ecosystem Enhancement PROGRAM

November 2011

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1.0 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 1.996 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. 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 (compiled based on North Carolina Ecosystem Enhancement Program [EEP's] *Procedural Guidance and Content Requirements for EEP Monitoring Reports* Version 1.3 dated 1/15/10) summarizes data for year 5 (2011) 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.

Vegetation success criteria dictate 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 607 stems per acre surviving in year 5 (2011). The dominant species identified at the Site were planted stems of bald cypress (*Taxodium distichum*), swamp blackgum (*Nyssa aquatica*), and buttonbush (*Cephalanthus occidentalis*). In addition, each individual vegetation plot met success criteria. Common reed (*Phragmites australis*) and kudzu (*Pueraria lobata*), invasive species previously located in the Site were treated chemically in early summer 2011. No new growth of common reed or kudzu was observed during the year 5 (2011) monitoring period. Growth of planted stems in the vicinity of vegetation plot 1 and the rain gauge has been slow most likely as the result of soil infertility from earth moving during construction; vigor of these stems is generally fair to good.

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 (the growing season in Pasquotank County begins April 7 and ends November 1 [209 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. Groundwater hydrology occurred within 12 inches of the soil surface for greater than 8.5 percent of the growing season at all groundwater gauges for the year 5 (2011) growing season with the exception of Gauge 1, which was inundated/saturated for greater than 5 percent of the growing season.

In summary, the Site is stable, and vegetation and groundwater hydrology were successful for the year 5 (2011) growing season. Summary information and data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in table and figures within this report's appendices. Narrative background and supporting

information formerly found in these reports can be found in the mitigation and restoration plan documents available on EEPs website. All raw data supporting the tables and figures in the appendices is available from EEP upon request.

2.0 METHODOLOGY

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 Figure 2 (Current Conditions Plan View) in Appendix B. The plots are 10 meters square and are located randomly within the Site. These plots were surveyed in June for the 2010 (year 4) 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 C. The taxonomic standard for vegetation used for this document was *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas* (Weakley 2007).

2.2 Wetland Assessment

Four groundwater monitoring gauges and one rain gauge have been maintained and monitored throughout the growing season. Graphs of groundwater hydrology and precipitation are included in Appendix D in addition to a figure depicting annual rainfall versus 30-year historic rainfall totals (Figure 3, Appendix D).

3.0 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.

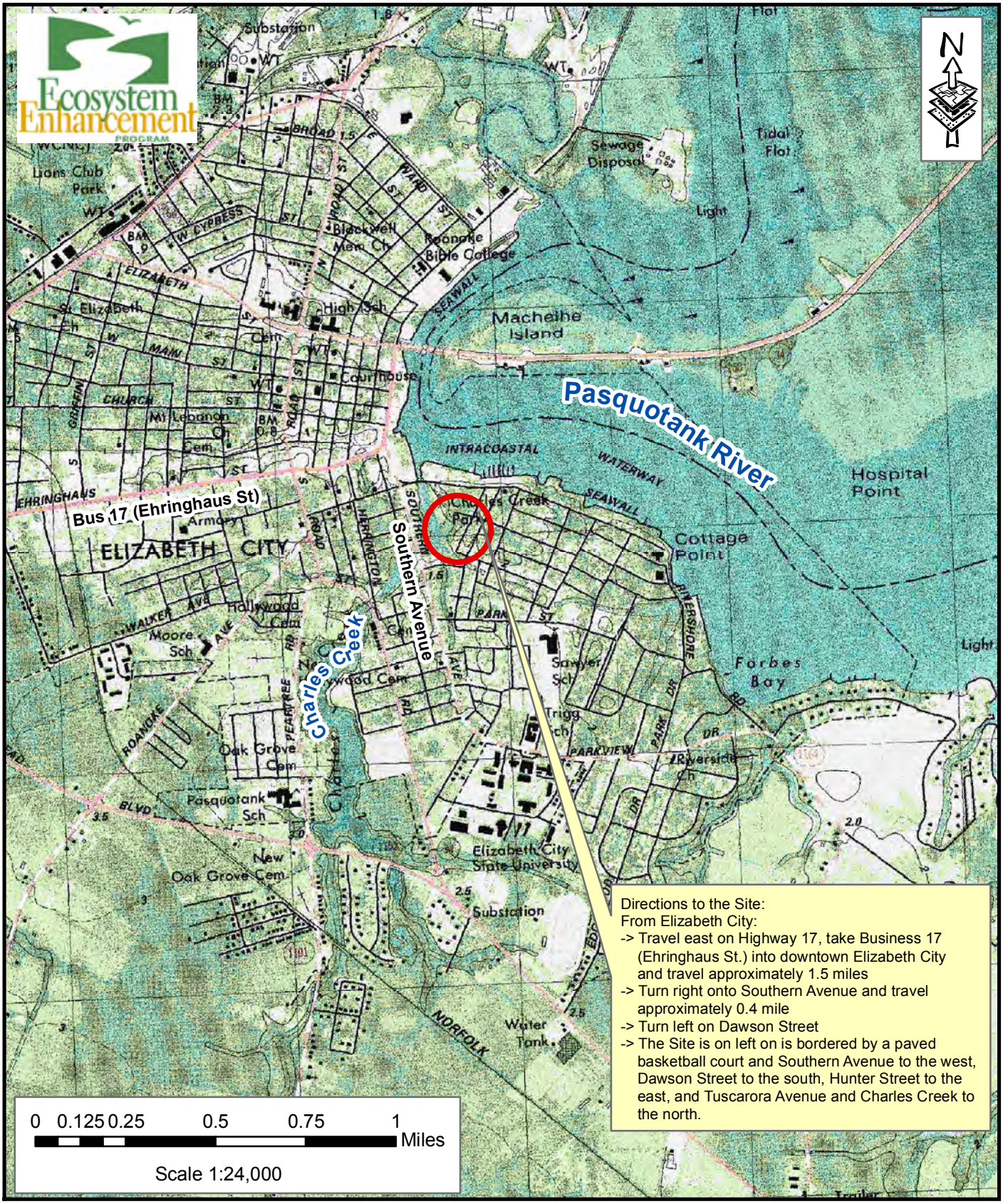
National Oceanic and Atmospheric Administration (NOAA). 2004. Climatography of the United States No. 20; Monthly Station Climate Summaries, 1971-2000. National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service, National Climatic Data Center, Asheville,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

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.

Weather Underground. 2011. Station at Elizabeth City Airport (KECG), North Carolina. (online). Available: http://www.wunderground.com/history/airport/KECG/2009/3/11/CustomHistory.html. [November 8, 2011]. Weather Underground.

APPENDIX A

PROJECT VICINITY MAP AND BACKGROUND TABLES



Axiom Environmental, Inc.
20 Enterprise Street
Suite 7
Raleigh, NC 27607
(919) 215-1693

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

Dwn. by.	FIGURE
CLF	1
Date: Nov 2010	
Project: 10-009	

Table 1. Project Components and Mitigation Credits
Charles Creek Park Wetland Restoration (EEP Project Number 79)

Mitigation Credits

	Riparian Wetland	
Type	Restoration	Restoration Equivalent
Totals	1.16	0.30

Project Components

Project Segment or Reach ID	Stationing/ Location	Existing Acreage	Approach	Restoration or Restoration Equivalent	Mitigation Ratio	Mitigation Units	Restoration Acreage	Mitigation Ratio
Restoration	NA	1.16	--	Restoration	1	1.16	1.16	1:1
Enhancement	NA	0.60	--	Enhancement	2	0.30	0.60	2:1
Open Water	NA	0.236	--	NA	NA	NA	NA	NA

Component Summation

Restoration Level	Riparian Wetland
	Riverine
Enhancement	0.60 acre
Restoration	1.16 acres
Totals	**1.76 acres**
Mitigation Credits	**1.46 WMUs**

Table 2. Project Activity and Reporting History
Charles Creek Park Wetland Restoration (EEP Project Number 79)

Elapsed Time Since Grading Complete: 5.5 years
Elapsed Time Since Planting Complete: 5.5 years
Number of Reporting Years: 5

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
Year 3 Monitoring (2009)	November 2009	November 2009
Year 4 Monitoring (2010)	November 2010	November 2010
Year 5 Monitoring (2011)	November 2011	November 2011

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 2-5 (2008-2011) Monitoring Performers	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, North Carolina 27603 Grant Lewis (919) 215-1693

Table 4. Project Baseline Information and Attributes Charles Creek Park Wetland Restoration (EEP Project Number 79)	
Project Information	
Project Name	Charles Creek Park Restoration Site
Project County	Pasquotank County, North Carolina
Project Area	1.996 acres
Project Coordinates	36.292956ºN, -76.216456ºW
Project Watershed Summary Information	
Physiographic Region	Coastal Plain
Ecoregion	Middle Atlantic Coastal Plain
Project River Basin	Pasquotank
USGS 8-digit HUC	03010205
USGS 14-digit HUC	03010205050010
NCDWQ Subbasin	03-01-50
Project Drainage Area	21.3 acres
Project Drainage Area Impervious Surface	< 20 percent
Wetland Summary Information	
Size of Wetland	1.76 acres
Wetland Type	Riverine riparian
Mapped Soil Series	Tetotom-Urban land complex/Chowan silt loam
Drainage Class	Moderately well/very poorly
Soil Hydric Status	Nonhydric/100% hydric
Source of Hydrology	Overbank
Regulatory Considerations	
Regulation	**Applicable**
Waters of the U.S. –Sections 404 and 401	Yes, resolved
Endangered Species Act	No
Historic Preservation Act	No
CZMA/CAMA	No
FEMA Floodplain Compliance	No
Essential Fisheries Habitat	No

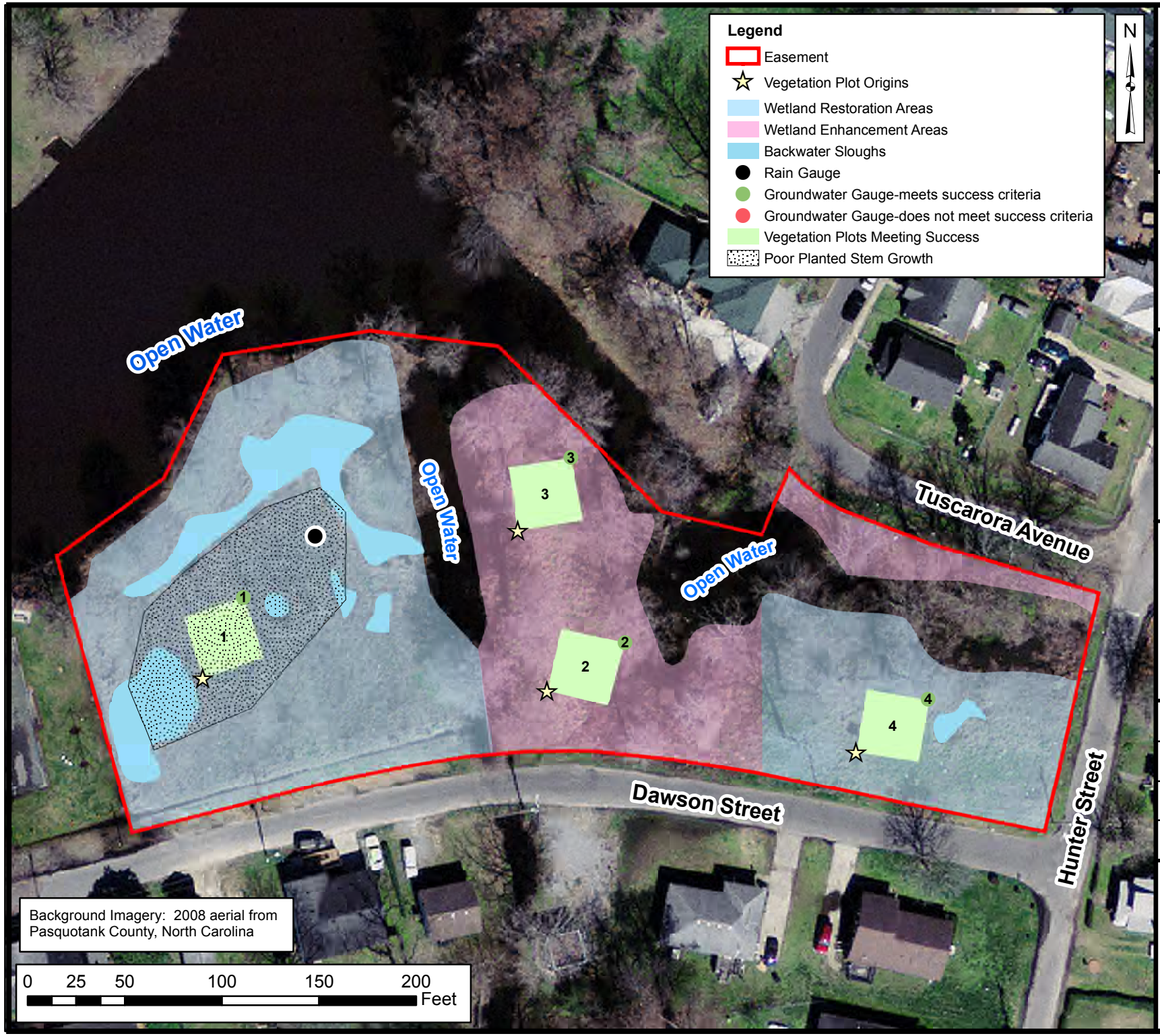
APPENDIX B

VISUAL ASSESSMENT DATA

Figure 2. Current Conditions Plan View

Table 5. Vegetation Condition Assessment Table

Vegetation Monitoring Plot Photos



Axiom Environmental, Inc.

Prepared for:

Ecosystem Enhancement Program

Project:

CHARLES CREEK PARK RESTORATION SITE

EEP Project # 79
Pasquotank County, NC

Title:

CURRENT CONDITIONS PLAN VIEW

Drawn by: CLF

Date: NOV 2011

Scale: 1:800

Project No.: 10-009

FIGURE

2

Table 5 **Vegetation Condition Assessment**

Charles Creek Park Wetland Restoration Site/EEP Project Number 79

Planted Acreage[1] **1.76**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	NA	NA	NA	NA	NA	NA
2. Low Stem Density Areas	NA	NA	NA	NA	NA	NA
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Poor growth of planted stems most likely resulting from soil infertility following site grading.	0.1 acres	Pattern and Color	1	0.20	11.4%
			Cumulative Total	1	0.20	11.4%

Easement Acreage[2] **1.996**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern [4]	NA	NA	NA	NA	NA	NA
5. Easement Encroachment Areas [3]	NA	NA	NA	NA	NA	NA

Charles Creek Park

Vegetation Monitoring Photographs

Taken July 2011

APPENDIX C

VEGETATION ASSESSMENT DATA

Table 6. Vegetation Plot Criteria Attainment

Table 7. CVS Vegetation Plot Metadata

Table 8. Total and Planted Stems by Plot and Species

Table 6. Vegetation Plot Mitigation Success Summary Table
Charles Creek Restoration Site (EEP Project Number 79)

Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
1	Yes	100%
2	Yes	
3	Yes	
4	Yes	

Table 7. CVS Vegetation Plot Metadata
Charles Creek Restoration Site (EEP Project Number 79)

Report Prepared By	Corri Faquin
Date Prepared	9/19/2011 14:02
database name	Axiom-EEP-2011-D.mdb
database location	C:\Axiom\Business\CVS
computer name	CORRI-PC
file size	42930176
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 PLANTED living stems of each species 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

Table 8. Total and Planted Stems by Plot and Species
Charles Creek Restoration Site (EEP Project Number 79)

			Current Plot Data (MY5 2011)												Annual Means								
			E79-AXE-0001			E79-AXE-0002			E79-AXE-0003			E79-AXE-0004			MY5 (2011)			MY4 (2010)			MY3 (2009)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree						1									1						
Acer rubrum	red maple	Tree						3									3			2			
Baccharis halimifolia	eastern baccharis	Shrub Tree			94			11			14			12			131			114			
Betula nigra	river birch	Tree			1												1						
Carya	hickory	Tree						3									3			1			
Carya illinoinensis	pecan	Tree																		4			
Cephalanthus occidentalis	common buttonbush	Shrub Tree	2	2	2	2	2	2				4	4	4	8	8	8	10	10	10	7	7	7
Chamaecyparis thyoides	Atlantic white cedar	Tree			4			1									5						
Clethra alnifolia	coastal sweetpepperbu	Shrub	1	1	1							2	2	2	3	3	3	3	3	3	3	3	3
Cornus amomum	silky dogwood	Shrub				1	1	1							1	1	1	2	2	2	4	4	4
Cyrilla racemiflora	swamp titi	Shrub Tree										3	3	3	3	3	3	3	3	3	5	5	5
Fraxinus americana	white ash	Tree									1						1						
Fraxinus pennsylvanica	green ash	Tree	2	2	2	1	1	1				2	2	2	5	5	5	5	5	5	5	5	5
Juniperus virginiana	eastern redcedar	Tree																		7			
Magnolia virginiana	sweetbay	Shrub Tree	1	1	1										1	1	1	2	2	2	3	3	3
Morella cerifera	wax myrtle	Shrub Tree			4			6									10			15			
Nyssa	tupelo	Tree																			1	1	1
Nyssa aquatica	water tupelo	Tree				3	3	3	3	3	3	3	3	3	9	9	9	9	9	9	8	8	8
Nyssa biflora	swamp tupelo	Tree				1	1	1							1	1	1	1	1	1			
Nyssa sylvatica	blackgum	Tree																			1	1	1
Persea palustris	swamp bay	Tree	2	2	2	2	2	2			1	2	2	4	6	6	9	6	6	6	4	4	4
Pinus taeda	loblolly pine	Tree			1												1			1			
Prunus serotina	black cherry	Shrub Tree																		1			
Quercus phellos	willow oak	Tree																1	1	1	1	1	1
Taxodium distichum	bald cypress	Tree	1	1	6	2	2	5	4	4	7	4	4	8	11	11	26	11	11	26	11	11	11
Ulmus	elm	Tree						10			1						11			13			
Unknown		unknown																1	1	1	1	1	1
Vaccinium	blueberry	Shrub Vine Tree																1	1	1	1	1	1
Viburnum dentatum	southern arrowwood	Shrub Tree	4	4	4				1	1	1				5	5	5	5	5	5	4	4	4
Viburnum nudum	possumhaw	Shrub Tree				2	2	2	1	1	1	4	4	4	7	7	7	6	6	6	5	5	5
		Stem count	13	13	122	14	14	52	9	9	29	24	24	42	60	60	245	66	66	239	64	64	64
		size (ares)	1			1			1			1			4			4			4		
		size (ACRES)	0.02			0.02			0.02			0.02			0.10			0.10			0.10		
		Species count	7	7	12	8	8	15	4	4	8	8	8	9	12	12	22	15	15	24	16	16	16
		Stems per ACRE	526.1	526.1	4937	566.6	566.6	2104	364.2	364.2	1174	971.2	971.2	1700	607	607	2479	667.7	667.7	2418	647.5	647.5	647.5

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

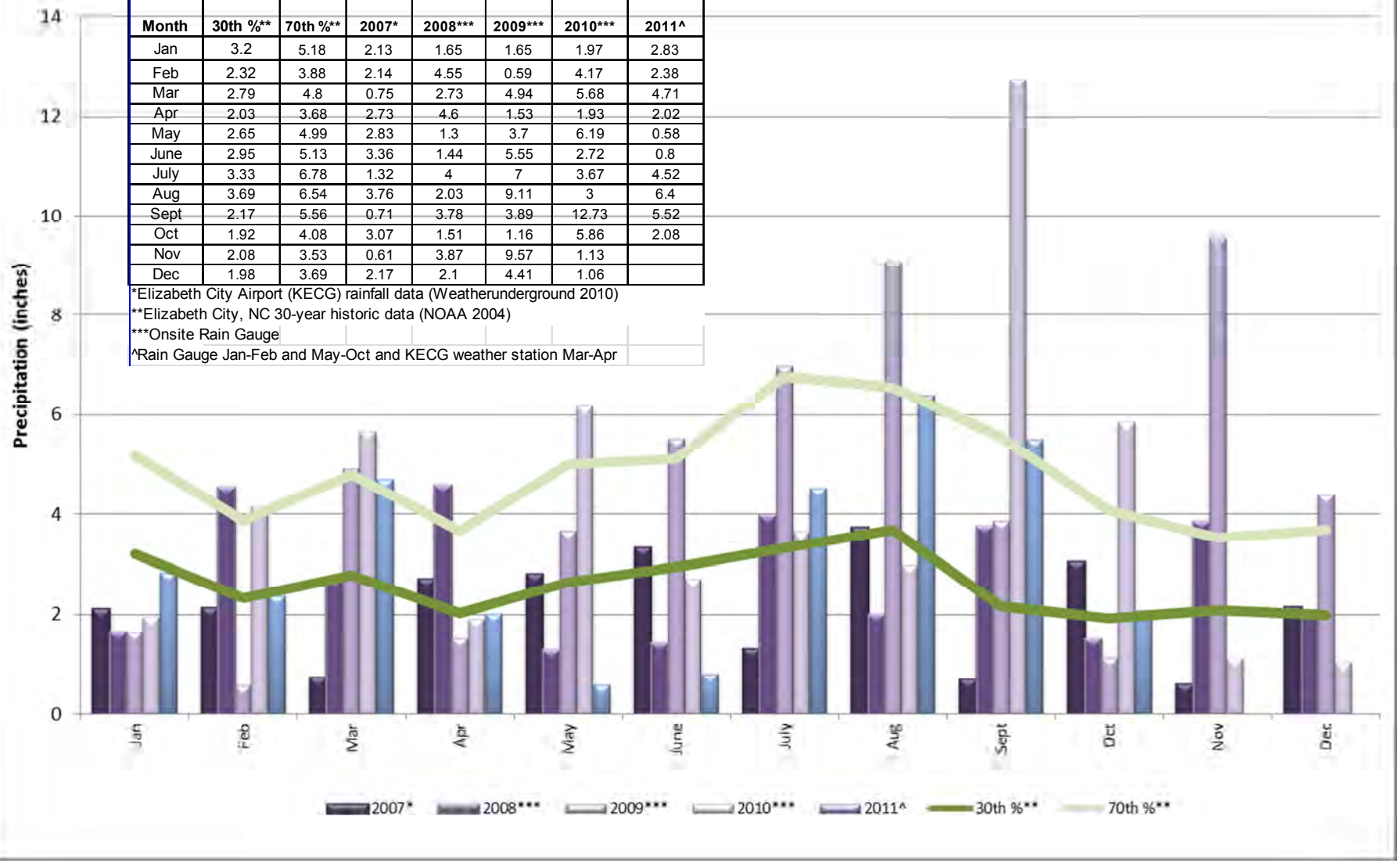
APPENDIX D
HYDROLOGY DATA

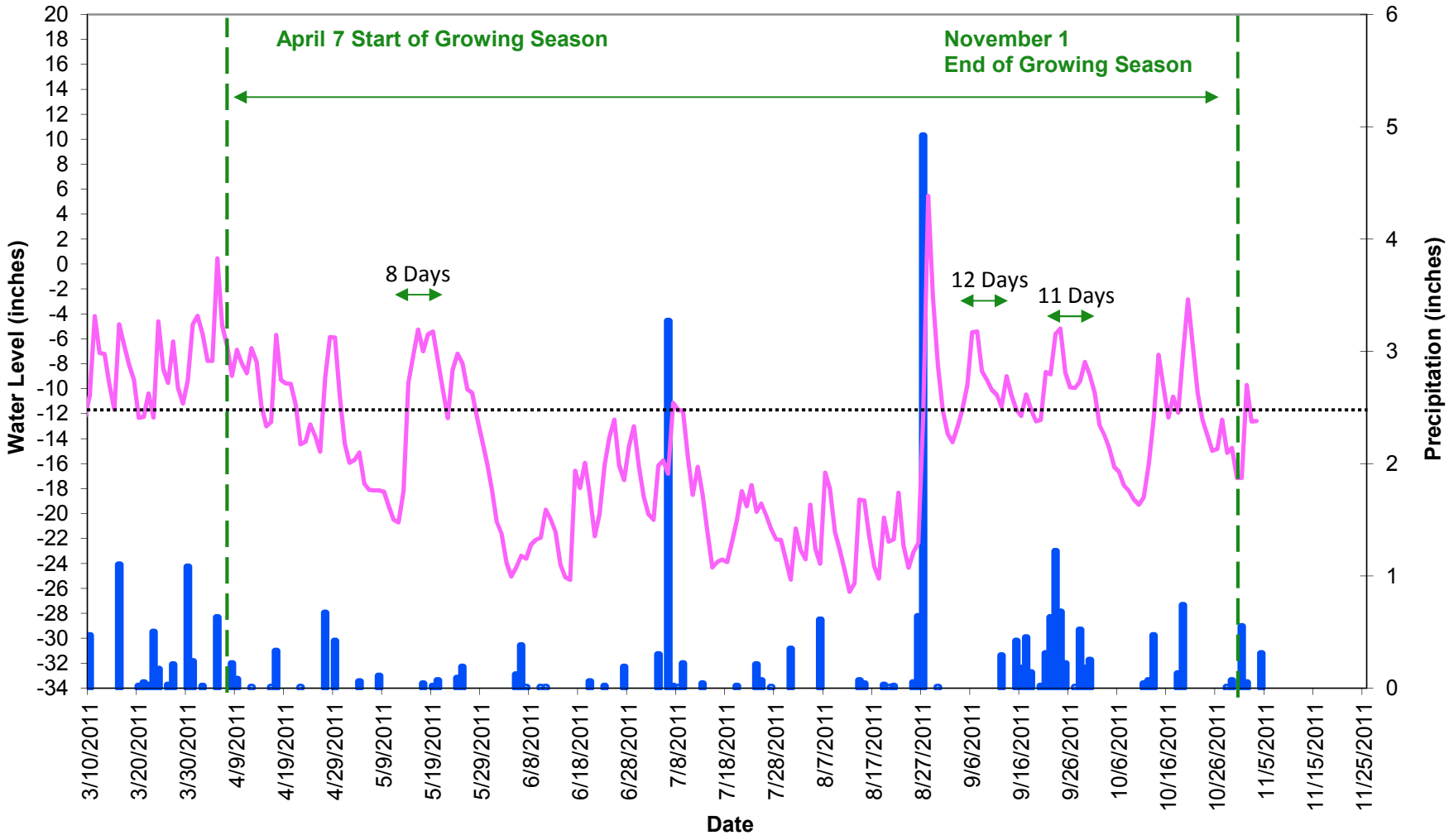
Figure 3. Annual Climatic Data vs. 30-year Historic Data
2011 (Year 5) Groundwater Gauge Graphs
Table 9. Wetland Hydrology Criteria Attainment Summary

Figure 3. Annual Climatic Data vs. 30-year Historic Data

Month	30th %**	70th %**	2007*	2008***	2009***	2010***	2011^
Jan	3.2	5.18	2.13	1.65	1.65	1.97	2.83
Feb	2.32	3.88	2.14	4.55	0.59	4.17	2.38
Mar	2.79	4.8	0.75	2.73	4.94	5.68	4.71
Apr	2.03	3.68	2.73	4.6	1.53	1.93	2.02
May	2.65	4.99	2.83	1.3	3.7	6.19	0.58
June	2.95	5.13	3.36	1.44	5.55	2.72	0.8
July	3.33	6.78	1.32	4	7	3.67	4.52
Aug	3.69	6.54	3.76	2.03	9.11	3	6.4
Sept	2.17	5.56	0.71	3.78	3.89	12.73	5.52
Oct	1.92	4.08	3.07	1.51	1.16	5.86	2.08
Nov	2.08	3.53	0.61	3.87	9.57	1.13	
Dec	1.98	3.69	2.17	2.1	4.41	1.06	

*Elizabeth City Airport (KECG) rainfall data (Weatherunderground 2010)
**Elizabeth City, NC 30-year historic data (NOAA 2004)
***Onsite Rain Gauge
^Rain Gauge Jan-Feb and May-Oct and KECG weather station Mar-Apr




Charles Creek - Groundwater Gauge 1
(2011 Data)
April 7 Start of Growing Season
November 1
End of Growing Season
8 Days
12 Days
11 Days
Water Level (inches)
Precipitation (inches)
Date
20
18
16
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
6
5
4
3
2
1
0
3/10/2011
3/20/2011
3/30/2011
4/9/2011
4/19/2011
4/29/2011
5/9/2011
5/19/2011
5/29/2011
6/8/2011
6/18/2011
6/28/2011
7/8/2011
7/18/2011
7/28/2011
8/7/2011
8/17/2011
8/27/2011
9/6/2011
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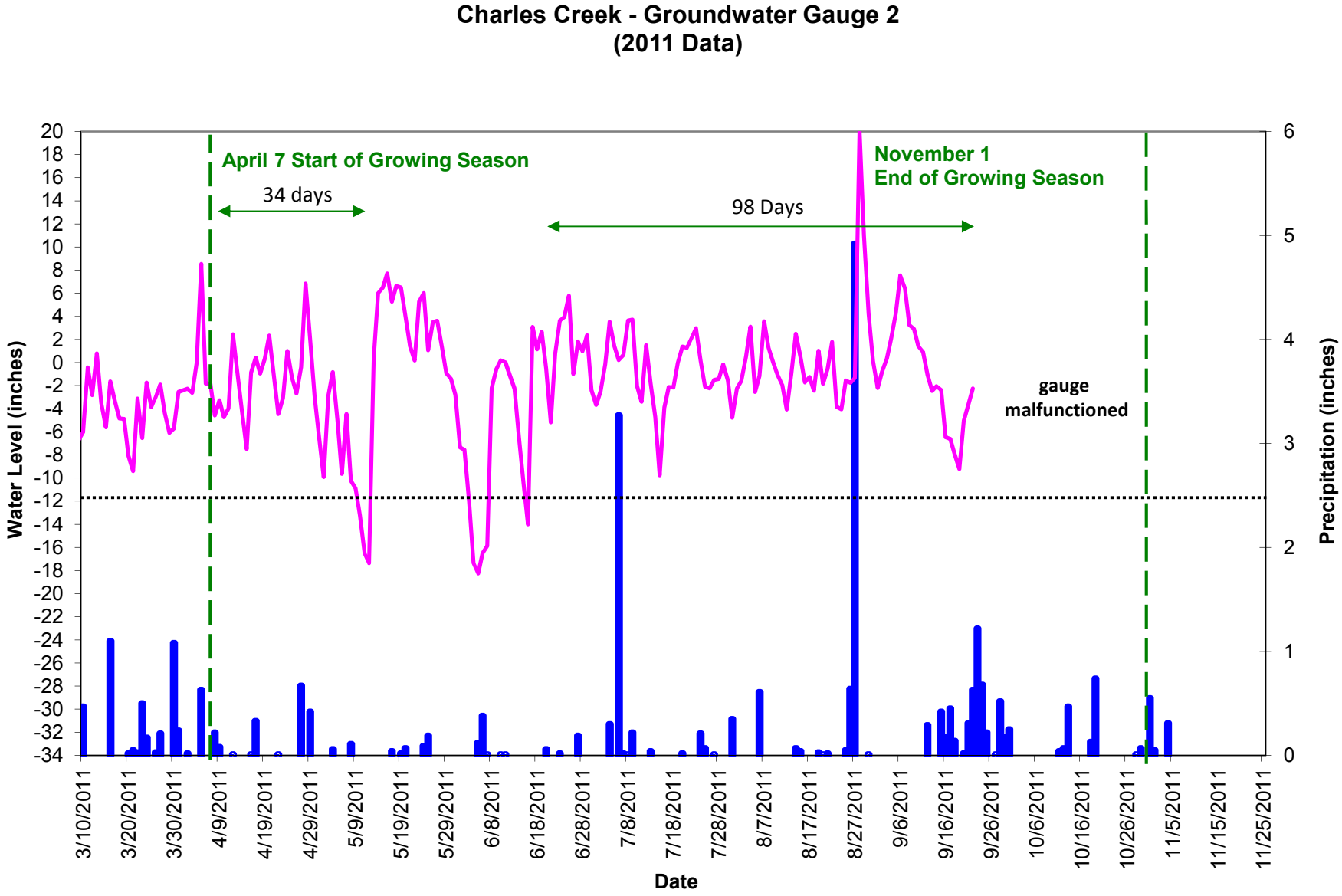
Charles Creek - Groundwater Gauge 2
(2011 Data)
April 7 Start of Growing Season
34 days
98 Days
November 1
End of Growing Season
gauge
malfunctioned
Water Level (inches)
Precipitation (inches)
Date
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
6
5
4
3
2
1
0
3/10/2011
3/20/2011
3/30/2011
4/9/2011
4/19/2011
4/29/2011
5/9/2011
5/19/2011
5/29/2011
6/8/2011
6/18/2011
6/28/2011
7/8/2011
7/18/2011
7/28/2011
8/7/2011
8/17/2011
8/27/2011
9/6/2011
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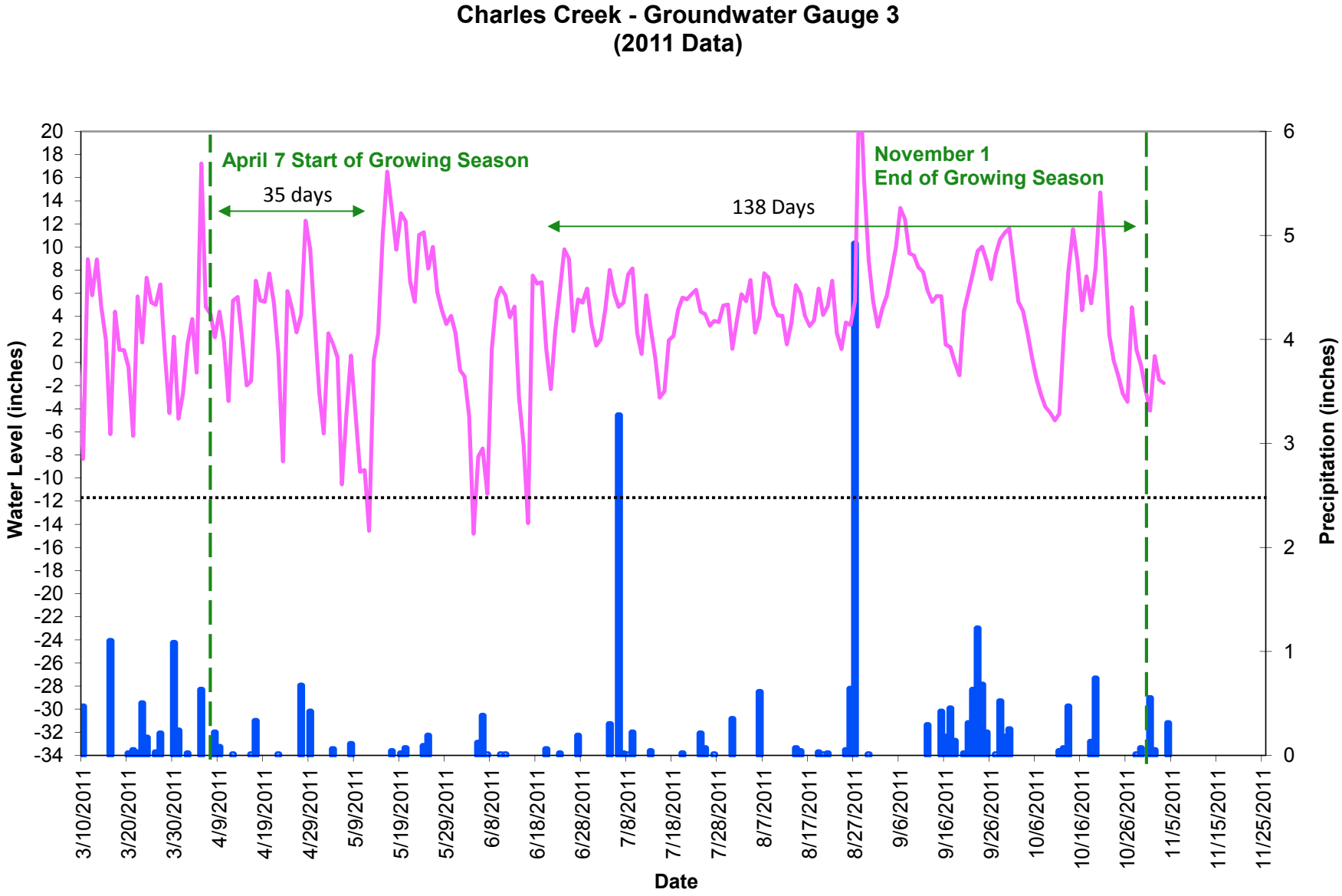
Charles Creek - Groundwater Gauge 3
(2011 Data)
April 7 Start of Growing Season
35 days
138 Days
November 1
End of Growing Season
Water Level (inches)
Precipitation (inches)
Date
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
6
5
4
3
2
1
0
3/10/2011
3/20/2011
3/30/2011
4/9/2011
4/19/2011
4/29/2011
5/9/2011
5/19/2011
5/29/2011
6/8/2011
6/18/2011
6/28/2011
7/8/2011
7/18/2011
7/28/2011
8/7/2011
8/17/2011
8/27/2011
9/6/2011
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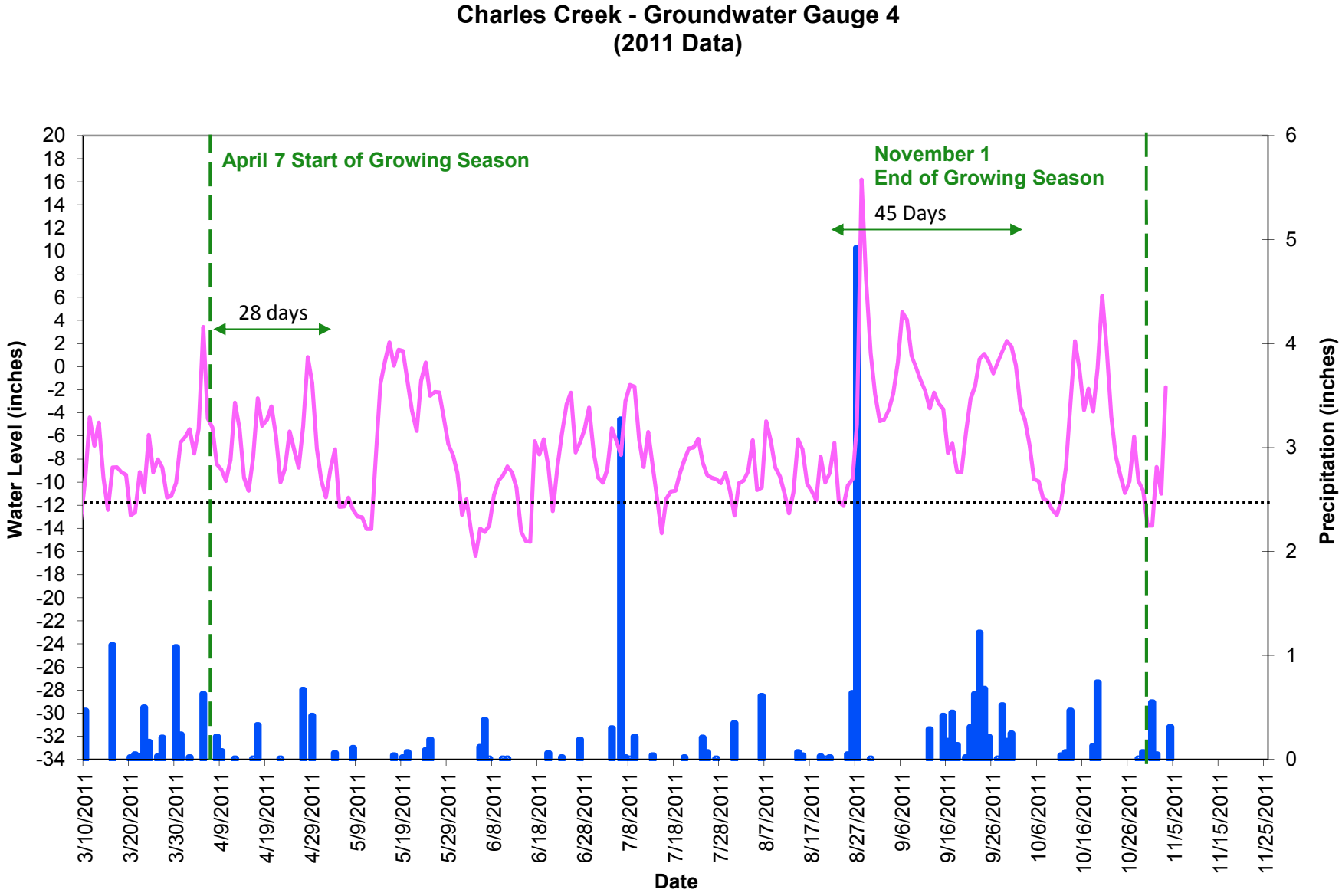
Charles Creek - Groundwater Gauge 4
(2011 Data)
April 7 Start of Growing Season
November 1
End of Growing Season
45 Days
28 days
Water Level (inches)
Precipitation (inches)
Date
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
6
5
4
3
2
1
0
3/10/2011
3/20/2011
3/30/2011
4/9/2011
4/19/2011
4/29/2011
5/9/2011
5/19/2011
5/29/2011
6/8/2011
6/18/2011
6/28/2011
7/8/2011
7/18/2011
7/28/2011
8/7/2011
8/17/2011
8/27/2011
9/6/2011
9/16/2011
9/26/2011
10/6/2011
10/16/2011
10/26/2011
11/5/2011
11/15/2011
11/25/2011

Table 9. Wetland Hydrology Criteria Attainment Summary
Charles Creek Restoration Site (EEP Project Number 79)

Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Year 1 (2007)	**Year 2 (2008)**	**Year 3 (2009)**	**Year 4 (2010)**	**Year 5 (2011)**
1	No/4 days (1.9%)	Yes/34 days (16.3%)	No/4 days (1.9%)	Yes/18 days (8.6%)	Yes/12 days (5.7%)
2	Yes/50 days (23.9%)	Yes/50 days (23.9%)	Yes/78 days (37.3%)	Yes/51 days (24.4%)	Yes/98 days (46.9%)
3	Yes/51 days (24.4%)	Yes/141 days (67.5%)	Yes/164 days (78.5%)	Yes/114 days (54.5%)	Yes/138 days (66.0%)
4	No/7 days (3.3%)	Yes/40 days (19.1%)	No/4 days (1.9%)	Yes/41 days (19.6%)	Yes/45 days (21.5%)