SANDY CREEK

Durham County, North Carolina
EEP Project No. 322
Contract No. D08039S

2012 Annual Monitoring Report
(Measurement Year-7 – MY7 (2012) – 3rd year post-repair)
Site Constructed 2003/Repaired 2008-2009/Replanted 2011

January 2013

Prepared for:

NCDENR-EEP
1619 Mail Service Center
Raleigh, NC 27699-1619

Prepared by:

The Catena Group
410B Millstone Drive
Hillsborough, NC 27278
919-732-1300

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1.0 EXECUTIVE SUMMARY

Sandy Creek is a wetland restoration and stream enhancement mitigation site located in Durham County, North Carolina. The project consists of 3.13 acres of wetland restoration and 2,461 linear feet of Level II stream enhancement. The conservation easement encompasses 22.6 acres and includes an additional 7.1 acres of preserved existing wetlands. Wetland and stream construction originally took place in 2003. Wetlands restoration consisted of grading activities and planting wetland vegetation. Stream enhancement consisted of the installation of log vanes to create pool features to enhance habitat and water quality along 2,461 linear feet of stream. The wetland restoration area was again re-graded between December 2009 and February 2010 to correct final grade elevations to establish proper wetland hydrology. Topsoil was added to improve soil fertility for plant growth and the graded areas were replanted with native plant species. This monitoring report represents the 3rd year of wetland monitoring after site maintenance and re-grading. Stream monitoring has been conducted annually since original restoration activities completed in 2003.

1.1 Goals and Objectives

Project Goals:

- Improve water quality by incorporating log vanes within the stream channel and planting the stream buffer
- Improve wetland hydrology with the removal of fill material and the sludge drying beds
- Improve in-stream habitat with the installation of log vanes to enhance pool depths
- Restore wetland function with the incorporation of woody and herbaceous wetland plant species

Project Objectives:

- The Level II stream enhancement of 2,461 linear feet of Sandy Creek
- Restoration of 3.13 acres of wetlands through the removal of fill material and the sludge drying beds to improve wetland hydrology
- Establishment of a 22.6 acres conservation easement

1.2 Vegetative Assessment

Currently the vegetation is meeting the success criterion with 759 total woody stems/acre. The success criterion for vegetation is 260 total woody stems/acre at the end of the monitoring period. Based on the CVS vegetation data there are 313 planted woody stems/acre and 759 total woody stems/acre. As a result of the wetland re-grading in December 2009, the vegetation in monitoring plots 2, 3, and 4 was removed, leaving only vegetation monitoring plot 1 intact. The site was replanted and plots 2, 3, and 4, were re-established in February 2010. Warranty planting was conducted in February 2011 to replace trees that did not survive initial replanting after the

wetland was re-graded. Level II of the CVS-EEP protocol was administered for plots 1, 2, 3, and 4, which accounts for natural and planted woody stems. Some planted stems are still exhibiting evidence of being smothered by the herbaceous vegetation (i.e. *Juncus effusus*). Vegetation problem areas are sections with low stem densities and invasive exotic species. Low stem densities occurred within the immediate vicinity of plot 1. Chinese lespedeza (*Lespedeza cuneata*), continues to thrive in patches along the adjacent forest margin and throughout the wetland in the vicinity of plots 3 and 4. These areas along the woodland margin have remained undisturbed throughout the monitoring period.

1.3 Stream Assessment

In general the stream banks are well vegetated and stable. The log vanes are stable and functioning as intended. The log vanes are providing adequate bank protection and generating scour pools, creating habitat. The cross section shows little change in stream dimension as compared to previous monitoring data. The erosion previously reported around the anchor boulder at the top of log vane 12 has stabilized and has not further degraded. Local debris buildup at log vane 6, station 13+83, is creating bank degradation issues. There is local erosion that may lead to the loss of a large tree on the bank. Woody debris has built up and is causing blockage to the two of the three existing box culverts under US 15-501 at the bottom of the project. The debris blockage can lead to backwater conditions that may degrade the habitat and stability functions of the structures directly upstream of the box culverts. Notification to NCDOT regarding the current blockage is recommended so maintenance can be performed.

1.4 Wetland Assessment

The site was re-graded between December 2009 and February 2010. New groundwater gauges were installed in the spring of 2010 at three locations – the reference wetland gauge, gauge A, and gauge C. Gauge B remained undisturbed in its original location. Only gauges A and B exhibited saturation within 12 inches of the ground surface for more than 12.5% of the growing season (Table 13). The average annual growing season for Durham County is 222 days (March 24 to November 1).

1.5 Annual Monitoring Summary

Summary information/data related to the occurrence of items such as beaver or encroachment, and statistics related to performance of various projects and monitoring elements, can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the mitigation and restoration plan documents available on EEP's website. All raw data supporting the tables and figures in the appendices are available from EEP upon request.

2.0 METHODOLOGY

All monitoring methodologies are a combination of current NCEEP templates and guidelines and previous monitoring reports (EEP template version 1.4 11/07/2011). Level II of the CVS –EEP Protocol for Recording Vegetation (Lee et al. 2008) was used for vegetation data collection. Photos were taken with a digital camera. A Trimble Geo XT handheld unit with sub-meter accuracy was used to collect monitoring feature locations and vegetation problem areas. Stream assessments followed methodologies outlined in *Applied River Morphology* (Rosgen 1996). Precipitation data were obtained from the State Climate Office of North Carolina (http://www.nc-climate.ncsu.edu/services/request.php) (State Office of North Carolina 2012). *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas* was the taxonomic standard used throughout vegetation data collection (Weakley 2011). Vegetation monitoring data was collected on August 15, 2012. Stream monitoring was conducted on March 23 and July 28, 2012.

3.0 REFERENCES

Lee, Michael T., R. K. Peet, S. D. Roberts, and T. R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation, Version 4.2 (http://cvs.bio.unc.edu/methods.htm)

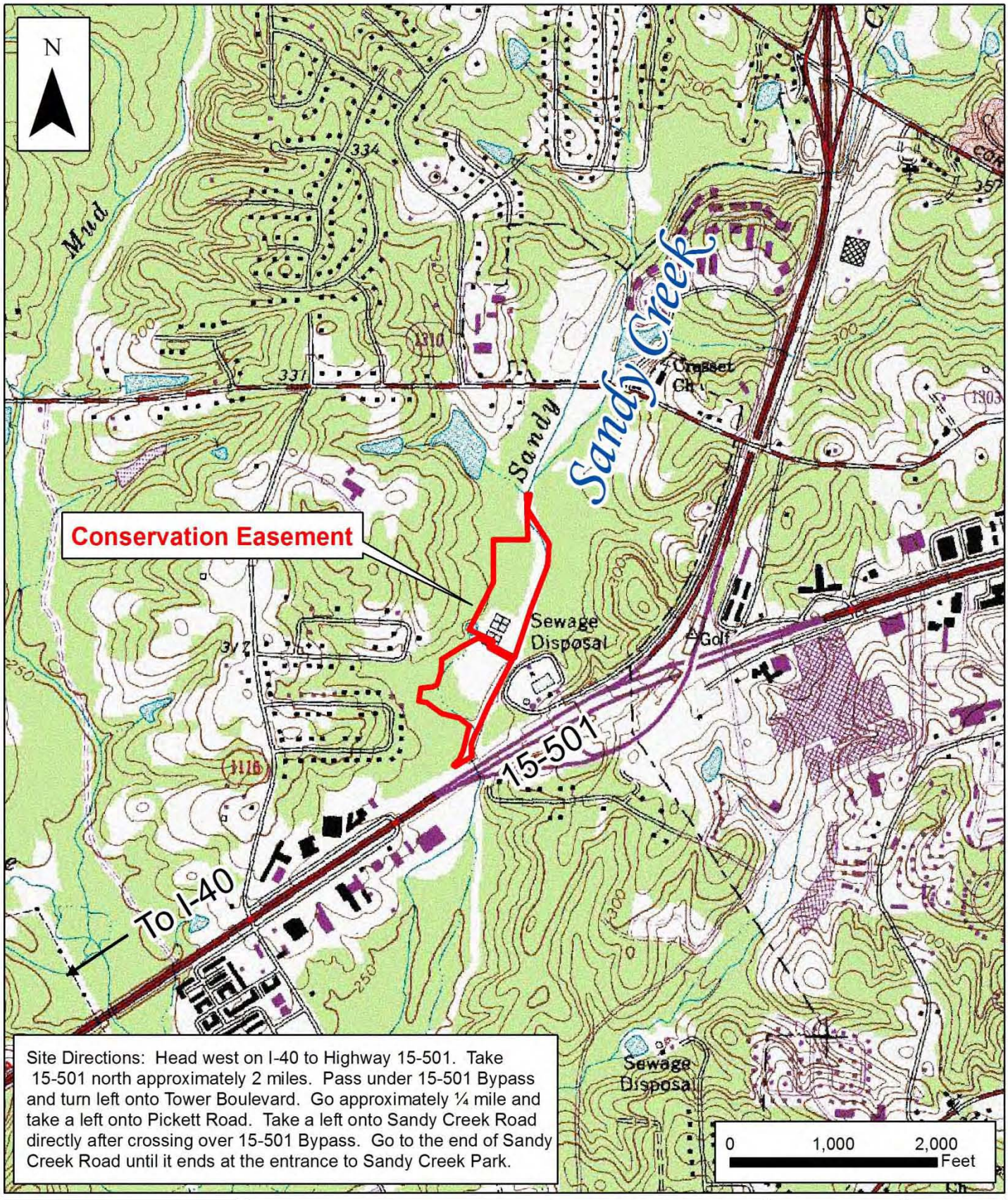
Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, CO.

State Climate Office of North Carolina. 2012. North Durham Water Reclamation Facility Precipitation Data (*Jan 1, 2010 – Oct 31, 2012; Daily Totals*). http://www.nc-climate.ncsu.edu/services/request.php.

Weakley, A.S. 2011. *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas*. Working draft of May 2011. University of North Carolina Herbarium, North Carolina Botanical Garden, University of North Carolina. 1015pp.

Appendix A

Project Vicinity Map and Background Tables



Site Directions: Head west on I-40 to Highway 15-501. Take 15-501 north approximately 2 miles. Pass under 15-501 Bypass and turn left onto Tower Boulevard. Go approximately ¼ mile and take a left onto Pickett Road. Take a left onto Sandy Creek Road directly after crossing over 15-501 Bypass. Go to the end of Sandy Creek Road until it ends at the entrance to Sandy Creek Park.

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Sandy Creek
Stream Enhancement and Wetland Restoration Site
Site Location Map
Durham County, North Carolina
USGS 7.5-Minute Topographic Quadrangle Map

EEP Project No. 322

Date:
January 2013

Ecosystem Enhancement Program

Figure
1

Table 1. Project Components and Mitigation Credits

Sandy Creek Stream Enhancement and Wetland Restoration Site/ EEP Project No. 322					
Project Segment or Reach ID	**Mitigation Type ***	**Approach ****	**Linear Footage or Acreage**	**Stationing**	**Comments**
Reach I	EII	BFI	2,461 linear feet	00+00 to 27+00	Primarily achieved with placement of log vanes
Wetland Restoration	R	~	3.13 acres	N/A	Wetland site re-graded and replanted in Dec 2009
Wetland Preservation	P	~	7.1 acres	N/A	7.1 acres of preserved wetlands are within the 22.63 acre conservation easement.

* EII = Enhancement II, R = Restoration. ** BFI = Bed form Improvement, P=Preservation

*** Stationing begins at downstream end of project and increases upstream

Table 2. Project Activity and Reporting History

Sandy Creek Stream Enhancement and Wetland Restoration Site / EEP Project No. 322
Elapsed Time Since Grading Complete: 3 years

Elapsed Time Since Planting: 19 Months

Number of Reporting Years[1]: 7

Activity Report	Scheduled Completion	Data Collection Complete	Actual Completion or Delivery
Restoration Plan	N/A*	N/A*	Aug 2002
Final Design (90%)	N/A*	N/A*	Dec 2002
Construction	N/A*	N/A*	Jun 2003
Temporary S&E mix applied to entire project area	N/A*	N/A*	Jun 2003
Permanent seed mix applied to reach/segments	N/A*	N/A*	Jun 2003
Bare root seedling installation	N/A*	N/A*	Jun 2003
Mitigation Plan/As-builts (Year 0 Monitoring – baseline)	N/A*	Jun 2003	Oct 2003
Year 1 Monitoring	N/A*	May 2004	Dec 2004
Site Replanting (portions of Zone 3)	~	~	Mid 2004
Year 1 Monitoring re-sampling	N/A*	Sep 2004	Dec 2004
Year 2 Monitoring (Vegetation)	Dec 2005	Oct 2005	Dec 2005
Year 2 Monitoring (Groundwater Gauges)	Dec 2005	Oct 2005	Dec 2005
Year 3 Monitoring (Vegetation)	Dec 2006	Oct 2006	Dec 2006
Year 3 Monitoring (Groundwater Gauges)	Dec 2006	Oct 2006	Dec 2006
Year 4 Monitoring (Vegetation)	Dec 2007	Oct 2007	Dec 2007
Year 4 Monitoring (Groundwater Gauges)	Dec 2007	Oct 2007	Dec 2007
Site Repair Period (Re-grading)	~	~	Nov 2009
Site Replanting	Dec 2009	~	Dec 2009
Year 5 Monitoring (Vegetation)	Nov 2010	Oct 2010	Nov 2010
Year 5 Monitoring (Groundwater Gauges)	Nov 2010	Oct 2010	Nov 2010
Warranty Planting	Feb 2011	~	Feb 2011
Year 6 Monitoring (Vegetation)	Aug 2011	Aug 2011	Dec 2011
Year 6 Monitoring (Groundwater Gauges)	Nov 2011	Nov 2011	Dec 2011
Year 7 Monitoring (Vegetation)	Aug 2012	Aug 2012	Aug 2012
Year 7 Monitoring (Groundwater Gauges)	Nov 2012	Nov 2012	Nov 2012

Bold items represent those events of deliverables that are variable. Plain-font items represent events that are standard over the course of a typical project.

*N/A –Data not available.

1-Equals the number of reports or data points produced excluding the baseline

Table 3. Project Contacts Table

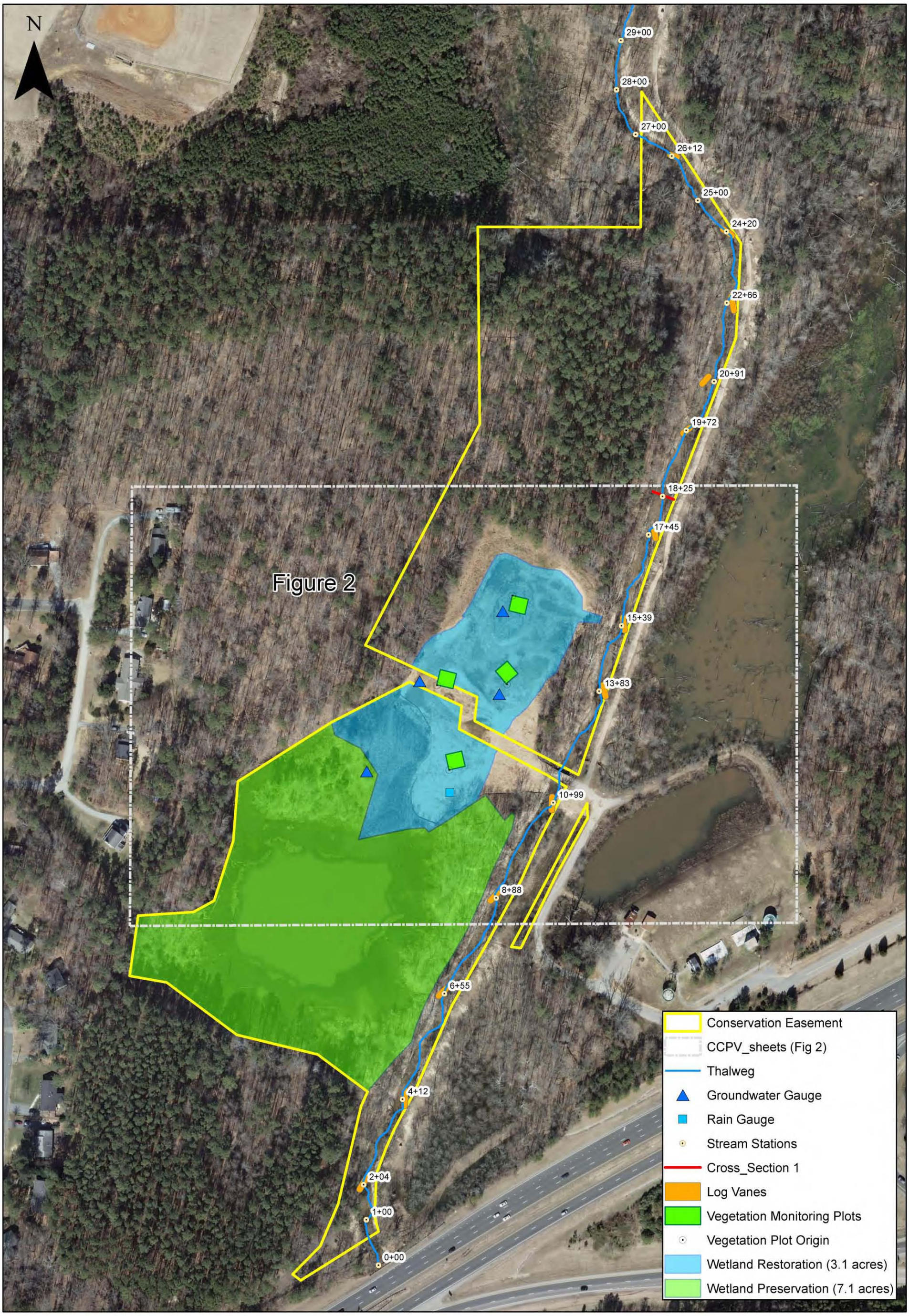
Sandy Creek Stream Enhancement and Wetland Restoration Site / EEP Project No. 322	
Designer: Ward Consulting Engineers, P.C.	8368 Six Forks Road, Suite 104 Raleigh, NC 27615-5083 Ph: 919-870-0526 email: bward@wce-corp.com
Construction Contractor: Shamrock Environmental, Inc.	Mr. Greg Kiser 6106 Corporate Park Drive Browns Summit, NC 27214 (336) 375-1989
Planting Contractor: Shamrock Environmental, Inc.	Mr. Greg Kiser 6106 Corporate Park Drive Browns Summit, NC 27214 (336) 375-1989
Seeding Contactor: Shamrock Environmental, Inc.	Mr. Greg Kiser 6106 Corporate Park Drive Browns Summit, NC 27214 (336) 375-1989
Seed Mix Sources	N/A*
Nursery Stock Suppliers	N/A*
Monitoring Performers (MY-01-04): EcoScience Corporation	1101 Haynes Street, Ste. 101 Raleigh, NC 27604 (919) 828-3433
Re-Designer: Ward Consulting Engineers, P.C.	8368 Six Forks Road, Suite 104 Raleigh, NC 27615-5083 Ph: 919-870-0526 email: bward@wce-corp.com
Re-Construction: Environmental Quality Resources, LLC	1405 Benson Court, Suite C Arbutus, MD 21227 Tel: (443) 304-3310
Re-Planting: Bruton Natural Systems, Inc.	P.O. Box 1197 Freemont, NC 27830 (919) 242-6555
Re-Seeding: Erosion Supply Company	P.O. Box 91208 Raleigh, NC 27675 (919) 787-0334
Monitoring Performers (MY-05+): The Catena Group	410B Millstone Drive Hillsborough, NC 27278 (919)732-1300

Table 4. Project Baseline Information and Attributes

Sandy Creek Stream Enhancement and Wetland Restoration Site / EEP Project No. 322	
Project County	Durham
Drainage Area	7.3 square miles to culvert at Bypass 15-501
Impervious cover estimate (%)	10 percent
Stream Order	3rd order
Physiographic Region	Piedmont
Ecoregion (Griffith and Omernik)	Triassic Basin
Rosgen Classification of As-built	NA (Enhancement only)
Cowardin Classification	Stream (R3UB2)
	Wetlands (PFO1)
Dominant soil types	Stream - Chewacla and Wehadkee soils (Ch)
	Wetlands - Urban Land (Ur)
SCO #ID 0	10542301
USGS HUC for Project and Reference	03030002060110 / N/A
NCDWQ Sub-basin for Project and Reference	03-06-05 / N/A
NCDWQ classification for Project and Reference	C, NSW / N/A
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	N/A
Percent of project easement fenced	None

Appendix B

Visual Assessment Data



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Sandy Creek: Wetland Restoration and Stream Enhancement Site

MY-07 CCPV Sheet Index

EEP Project No. 322
2010 Aerial Photography

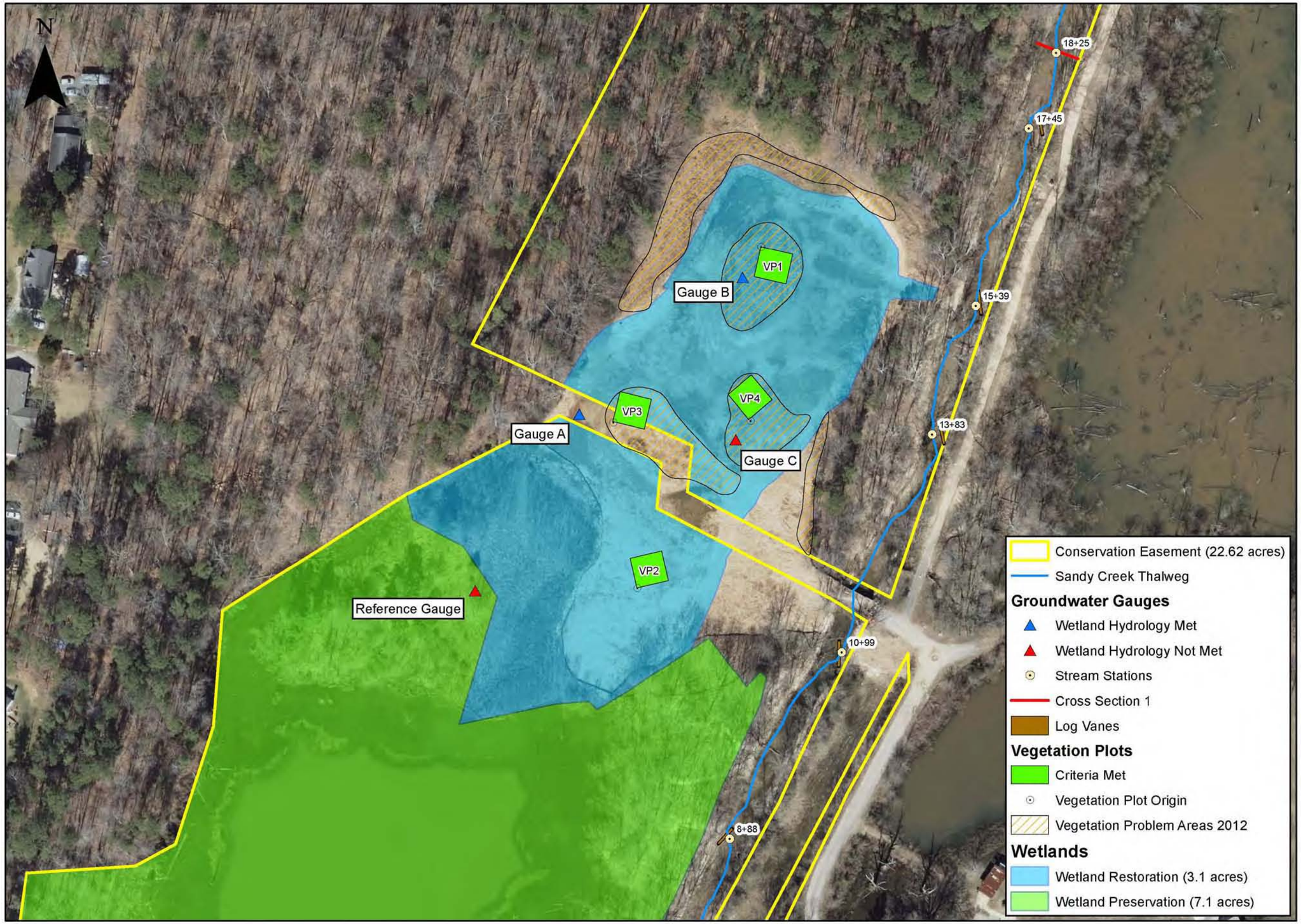
Durham County, North Carolina

Date: January 2013

Scale: 0 50 100 200 Feet

Job No: 4134

Figure 2



The Catena Group

Date: January 2013

Scale: 0 50 100 Feet

Job No. 4143

Title:
Sandy Creek Wetland Restoration and Stream Enhancement Site MY-07 CCPV

EEP Project No. 322

2010 Aerial Orthophotography (NC OneMaps)

Durham County, North Carolina

Client:

Ecosystem Enhancement Program

Figure
3

Table 5. Visual Stream Morphology Stability Assessment Table

Not provided as project contains only stream enhancement via log vanes.

Table 6. Vegetation Condition Assessment Table

Table 6 — Vegetation Condition Assessment

Planted Acreage[1] 10.9

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	7	0.30	2.8%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	4	0.10	0.9%
			Total	11	0.40	3.7%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	3	0.40	3.7%
			Cumulative Total	14	0.80	7.3%

Easement Acreage[2] 14

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	Areas or points (if too small to render as polygons at map scale).	1000 SF	Pattern and Color	7	0.70	5.0%
5. Easement Encroachment Areas[3]	Areas or points (if too small to render as polygons at map scale).	none	Pattern and Color	2	0.10	0.9%

1 = Enter the planted acreage within the easement. This number is calculated as the easement acreage minus any existing mature tree stands that were not subject to supplemental planting of the understory, the channel acreage, crossings or any other elements not directly planted as part of the project effort.

2 = The acreage within the easement boundaries.

3 = Encroachment may occur within or outside of planted areas and will therefore be calculated against the overall easement acreage. In the event a polygon is cataloged into items 1, 2 or 3 in the table and is the result of encroachment, the associated acreage should be tallied in the relevant item (i.e., item 1,2 or 3) as well as a parallel tally in item 5.

4 = Invasives may occur in or out of planted areas, but still within the easement and will therefore be calculated against the overall easement acreage. Invasives of concern/interest are listed below. The list of high concern spcies are those with the potential to directly outcompete native, young, woody stems in the short-term (e.g. monitoring period or shortly thereafter) or affect the community structure for existing, more established tree/shrub stands over timeframes that are slightly longer (e.g. 1-2 decades). The low/moderate concern group are those species that generally do not have this capacity over the timeframes discussed and therefore are not expected to be mapped with regularity, but can be mapped, if in the judgement of the observer their coverage, density or distribution is suppressing the viability, density, or growth of planted woody stems. Decisions as to whether remediation will be needed are based on the integration of risk factors by EEP such as species present, their coverage, distribution relative to native biomass, and the practicality of treatment. For example, even modest amounts of Kudzu or Japanese Knotweed early in the projects history will warrant control, but potentially large coverages of Microstegium in the herb layer will not likley trigger control because of the limited capacities to impact tree/shrub layers within the timeframes discussed and the potential impacts of treating extensive amounts of ground cover. Those species with the "watch list" designator in gray shade are of interest as well, but have yet to be observed across the state with any frequency. Those in *red italics* are of particular interest given their extreme risk/threat level for mapping as points where isolated specimens are found, particularly ealry in a projects monitoring history. However, areas of discreet, dense patches will of course be mapped as polygons. The symbology scheme below was one that was found to be helpful for symbolzing invasives polygons, particularly for situations where the conditon for an area is somewhere between isolated specimens and dense, discreet patches. In any case, the point or polygon/area feature can be symbolized to describe things like high or low concern and species can be listed as a map inset, in legend items if the number of species are limited or in

Sandy Creek Stream Enhancement Photo Stations

Photo Station 1: Log Vane #1 (Station 2 + 04)

Photo Station 2: Log Vane #2 (Station 4 + 12)

Photo Station 3: Log Vane #3 (Station 6 + 55)

Photo Station 4: Log Vane #4 (Station 8 + 88)

Photo Station 5: Log Vane #5 (Station 10 + 99)

Photo Station 6: Log Vane #6 (Station 13 + 83)

Photo Station 7: Log Vane #7 (Station 15 + 39)

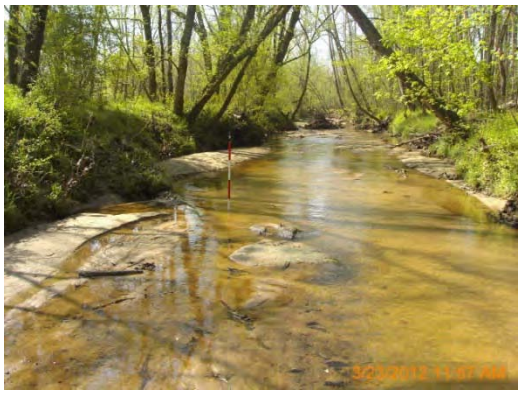


Photo Station 8: Log Vane #8 (Station 17 + 45)

Photo Station 9: Log Vane #9 (Station 19 + 72)

Photo Station 10: Log Vane #10 (Station 20 + 91)

Photo Station 11: Log Vane #11 (Station 22 + 66)

Photo Station 12: Log Vane #12 (Station 24 + 20)
Note exposed boulder, no change from previous year

Photo Station 13: Log Vane #13 (Station 26 + 12)

Vegetation Plot Photos

MY05 Aug 16, 2010	MY06 Aug 24, 2011	MY07 Aug 15, 2012
		
Plot 1	Plot 1	Plot 1
		
Plot 2	Plot 2	Plot 2
		
Plot 3	Plot 3	Plot 3

MY05 Aug 16, 2010

Plot 4

MY06 Aug 24, 2011

Plot 4

MY07 Aug 15, 2012

Plot 4

Appendix C

Vegetation Plot Data

Table 7. Vegetation Plot Success Summary Table

Sandy Creek Stream Enhancement and Wetland Restoration Site / EEP Project No. 322			
Plot ID	**Vegetation Survival Threshold Met? (260 total woody stems/acre)**	**Planted Stem Density stems/acre**	**Total Stem Density stems/acre**
P1	Yes	161	485
P2	Yes	323	849
P3	Yes	364	1214
P4	Yes	404	485

Table 8. Vegetation Metadata Table

Report Prepared By	The Catena Group
Date Prepared	10/31/2012 11:27
database name	
database location	TheCatenaGroup-2012-K-SandyCreek_MY7.mdb
computer name	P:\Jobs\2008\4130-34 (EEP Monitoring)\4134 (Sandy Crk)\2012_MY-07
file size	
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	
Proj, planted	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, total stems	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Plots	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.
Vigor	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor by Spp	Frequency distribution of vigor classes for stems for all plots.
Damage	Frequency distribution of vigor classes listed by species.
Damage by Spp	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Plot	Damage values tallied by type for each species.
Planted Stems by Plot and Spp	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	322
project Name	Sandy Creek
Description	Sandy Creek Wetland Restoration and Stream Enhancement Project MY-06 (2010) EEP project # 322; 1st CVS year for VP 1; VP 2,3,&4 reset in February 2010;
River Basin	Cape Fear
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	4

Table 9. CVS Stem Count Total and Planted by Plot and Species

EEP Project Code 322. Project Name: Sandy Creek

			Current Plot Data (MY7 2012)												Annual Means								
			E322-01-0001			E322-01-0002			E322-01-0003			E322-01-0004			MY7 (2012)			MY6 (2011)			MY5 (2010)		
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 negundo var. negundo	boxelder	Tree																		1			2
Baccharis halimifolia	eastern baccharis	Shrub									1						1			1			
Betula nigra	river birch	Tree				1	1	1				5	5	5	6	6	6	4	4	5	1	1	1
Carpinus caroliniana var. ca	Coastal American Horn	Tree				1	1	1				1	1	1	2	2	2	2	2	2	2	2	2
Cephalanthus occidentalis	common buttonbush	Shrub							1	1	1	1	1	1	2	2	2	1	1	1	2	2	2
Cornus amomum	silky dogwood	Shrub							1	1	1	1	1	1	2	2	2	1	1	1	1	1	1
Fraxinus pennsylvanica	green ash	Tree				5	5	9			1			1	5	5	11	5	5	8	4	4	4
Gleditsia triacanthos	honeylocust	Tree																		1			
Liriodendron tulipifera var.	Tulip-tree, Yellow Popl	Tree																1	1	1			
Nyssa sylvatica	blackgum	Tree																			1	1	1
Platanus occidentalis var. oc	Sycamore, Plane-tree	Tree																1	1	1	2	2	2
Quercus	oak	Tree																					1
Quercus lyrata	overcup oak	Tree							1	1	1				1	1	1	1	1	1	1	1	1
Quercus michauxii	swamp chestnut oak	Tree				1	1	1				1	1	1	2	2	2	2	2	2			
Quercus phellos	willow oak	Tree							6	6	6				6	6	6	7	7	7	3	3	3
Robinia pseudoacacia	black locust	Tree			1												1						2
Salix nigra	black willow	Tree	4	4	5			9			19	1	1	2	5	5	35	5	5	32	7	7	7
Ulmus	elm	Tree																					4
Ulmus rubra	slippery elm	Tree			5												5			4			
		Stem count	4	4	12	8	8	21	9	9	30	10	10	12	31	31	75	30	30	68	24	24	33
		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	1	1	4	4	4	5	4	4	7	6	6	7	9	9	13	11	11	15	10	10	14
		Stems per ACRE	161.9	161.9	485.6	323.7	323.7	849.8	364.2	364.2	1214	404.7	404.7	485.6	313.6	313.6	758.8	303.5	303.5	688	242.8	242.8	333.9

Appendix D

Stream Survey Data

Cross Sectional Profiles with Annual Overlays

Project:	Sandy Creek/Project No. 322
Cross Section:	Cross Section 1
Feature	Riffle
Station:	18+25
Date:	7/28/12
Crew:	ZP, SV

Summary (bankfull)

	MY0	MY2	MY3	MY5	MY6	MY7
A (BKF)	109.6	114.7	119.7	110.5	105.9	107.9
W (BKF)	31.4	31.4	31.2	31.3	30.9	30.7
Max d	4.1	4.6	5.3	4.2	4.1	4.2
Mean d	3.5	3.7	3.8	3.5	3.4	3.5
W/D	9.0	8.6	8.1	8.9	9.0	8.7

MY00-2003			MY02-2005			MY03-2006			MY05-2010			MY06-2011			MY07-2012		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes
1.00	264.33		1.00	264.50		1.00	264.55	LPIN	1.00	264.55	LEFT PIN	1.00	265.02	LPIN	1.00	265.09	LPIN
5.70	264.44		3.00	264.57		2.00	264.60		5.00	264.80		1.00	264.55		1.00	264.60	
8.00	264.20		5.00	264.66		4.00	264.69		8.00	264.55	TOBL	4.00	264.66		6.00	264.87	
9.50	263.64	BL Bankfull	7.00	264.60	TOBL	6.00	264.78		9.00	263.86	Bankfull Lef	6.50	264.79		8.00	264.69	TOBL
9.90	262.79		8.00	264.29		8.00	264.47	TOBL	10.00	262.72		8.00	264.65	BL Bankfull	9.00	263.83	
10.30	262.40		9.00	263.82	Bankfull Lef	8.70	264.24		11.50	261.58		11.00	261.90		10.70	262.21	
11.20	261.72		10.00	262.78		9.50	263.84	Bankfull Lef	12.60	260.06	TOE L	12.50	260.03	Toe L	12.00	260.95	
12.00	261.12		11.00	261.96		10.00	263.11		17.60	259.84		14.00	260.19		12.50	260.05	TOE L
12.20	260.07	Toe L	11.80	261.04		11.30	262.01		19.00	259.71		18.00	259.87		14.00	259.80	
13.00	259.97		12.00	259.54	Toe L	11.70	261.48		22.00	259.65		22.00	259.92		16.00	259.72	
14.00	259.99		15.00	259.49		12.40	260.37		23.00	259.75		28.00	259.58	TW	19.00	259.86	
15.00	259.87		17.00	259.79		14.00	260.32		26.60	259.64	(WS = 259	30.50	259.72	GS / WSEL	22.00	259.83	
16.00	259.83		21.00	259.82		18.00	260.49		31.00	259.93		34.00	259.85		26.00	259.43	TW
17.00	259.86		25.00	259.88		19.50	260.11		35.00	260.02		36.00	259.77		29.00	259.61	
18.00	259.83		31.00	259.77		23.00	260.00		37.20	259.75	TOE R	38.00	259.50	TOE R	32.00	259.68	
19.00	259.82		33.70	259.71		27.00	259.42		38.40	262.10		38.50	262.08		35.00	259.65	
22.00	259.60		35.00	259.51		32.00	258.52	TW	39.25	262.85	Bankfull righ	40.20	263.84		37.80	259.55	TOE R
23.00	259.72		35.70	259.37		36.00	258.66		40.40	263.97		41.00	264.04		38.50	262.13	
35.50	259.51	WS = elev 2	37.00	259.27	TW	38.20	258.76	Toe R	41.30	264.41	TOBR	43.00	264.50	R Bankfull	39.50	263.38	
36.40	259.70		37.90	259.70	Toe R	39.00	262.32		44.00	264.52		46.00	264.30		41.00	264.47	TOBR
37.40	259.81	Toe R	38.70	262.01		41.00	264.13	TOBR	48.00	264.16	RIGHT PIN	48.00	264.10		43.00	264.53	
38.40	260.96		39.60	263.09		43.00	264.47					48.00	264.50	RPIN	45.00	264.44	
39.10	262.08		40.00	263.66		46.00	264.36								48.00	264.16	
39.70	262.64		41.00	264.11		48.00	264.19	RPIN							48.00	264.57	RPIN
41.60	264.18	TOBR	42.00	264.35	TOBR												
43.00	264.30		45.00	264.35													
45.00	264.31		48.00	264.18													
48.00	264.13																

Photo of XS-1, looking in the downstream direction

Longitudinal Profiles with Annual Overlays

Not provided as project contains only stream enhancement via log vanes.

Pebble Count Plots with Annual Overlays

Not provided as project contains only stream enhancement via log vanes.

Table 10a and b. Baseline – Stream Data Summary

Not provided as project contains only stream enhancement via log vanes.

Table 11a and b. Monitoring – Dimensional Morphology Summary

Not provided as project contains only stream enhancement via log vanes.

Appendix E

Hydrologic Data

Table 12. Verification of Bankfull Events

Not provided as project contains only stream enhancement via log vanes.

Figure 4. Monthly Rainfall Data for Entire Year

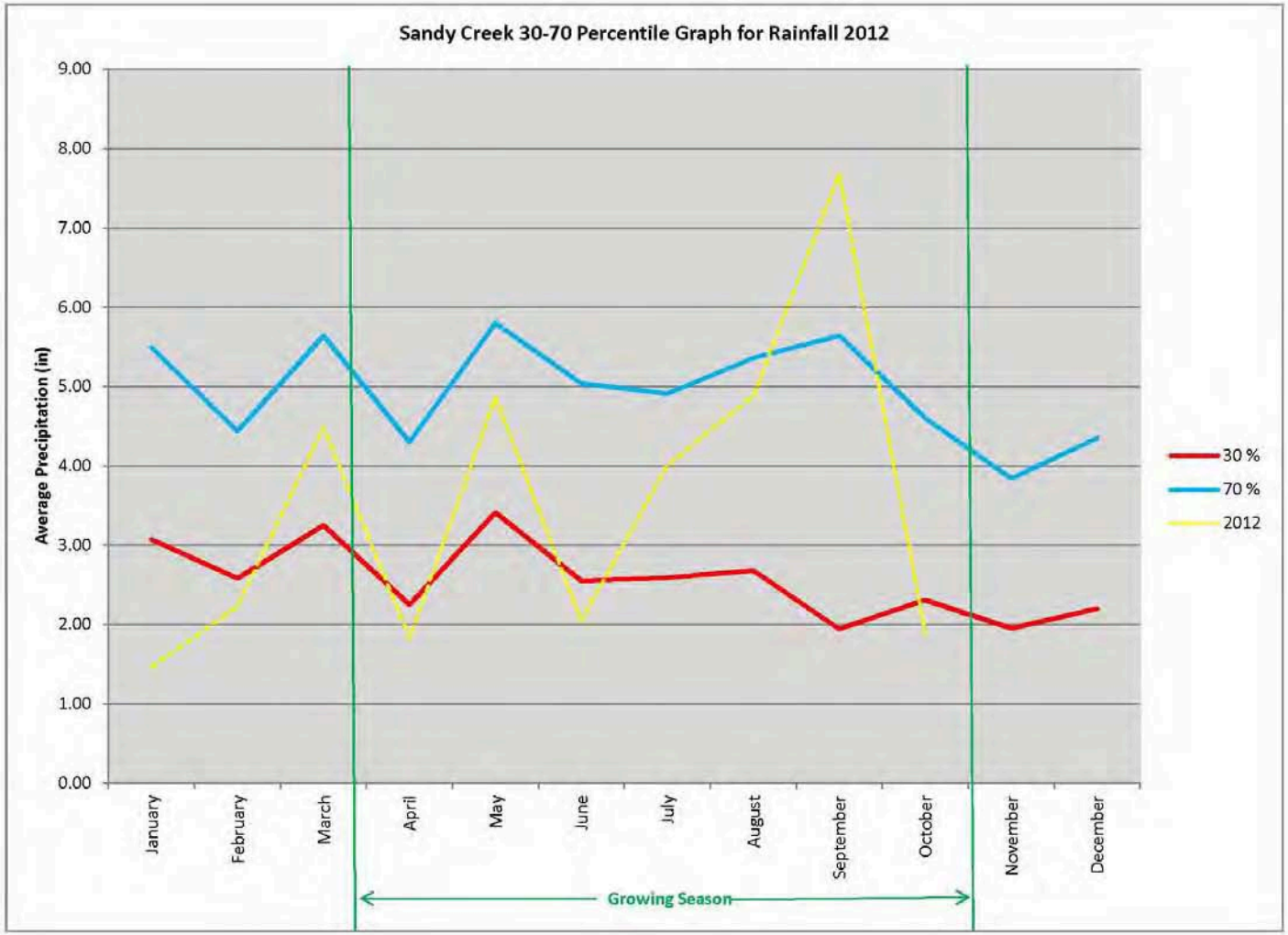
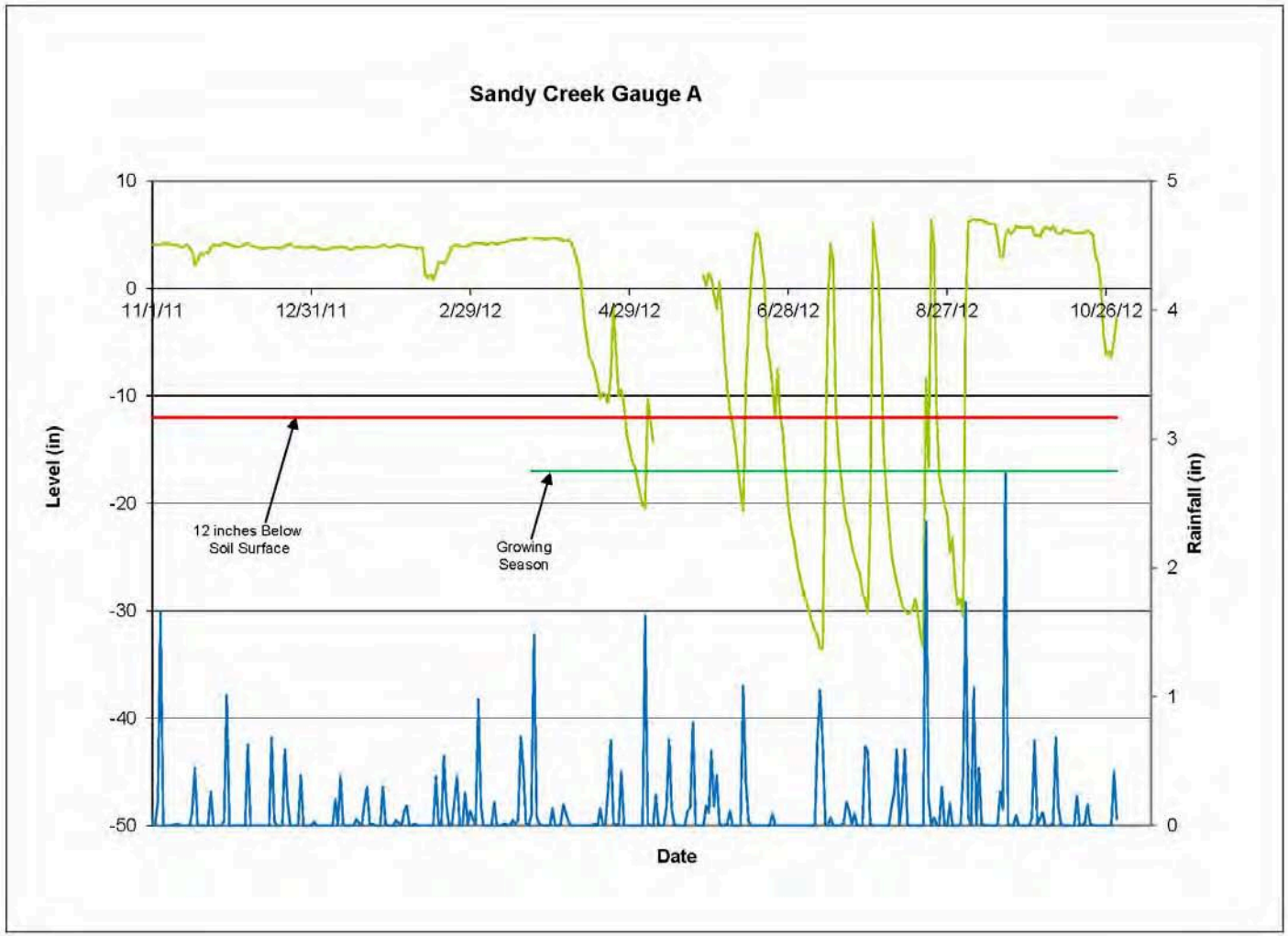
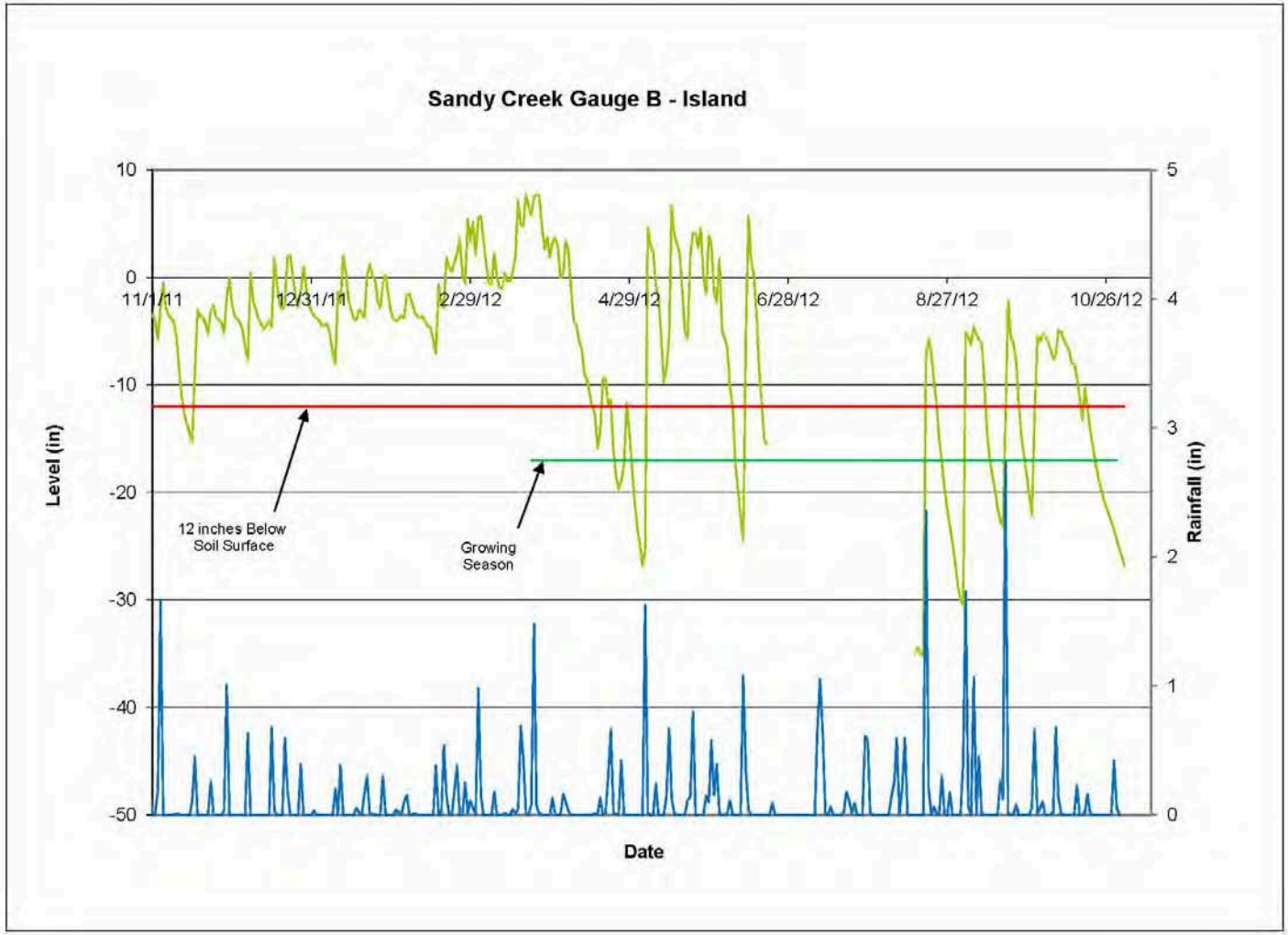
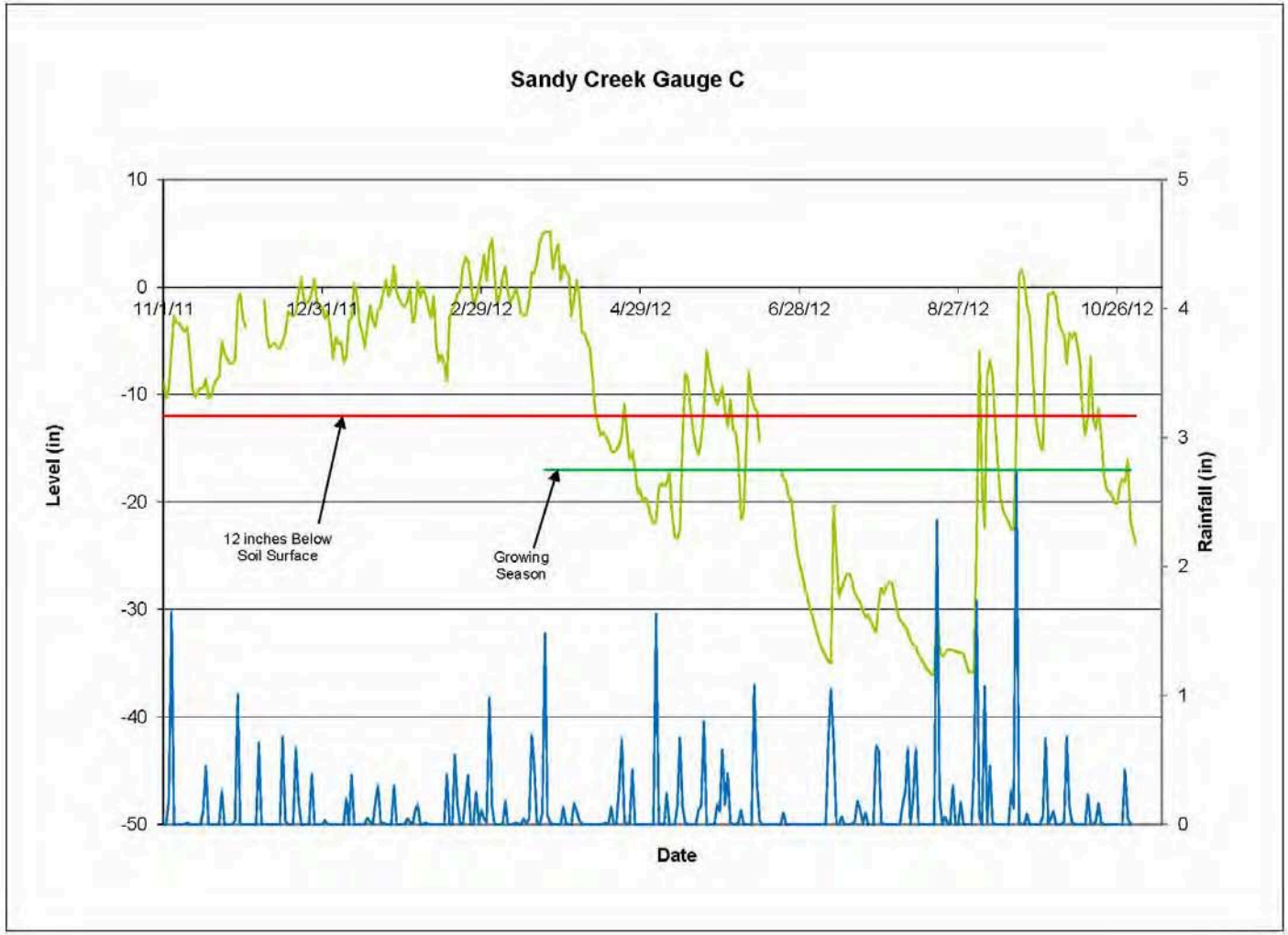


Figure 5. Precipitation and Water Level Plots




Sandy Creek Gauge B - Island
10
0
-10
-20
-30
-40
-50
5
4
3
2
1
0
11/1/11
12/31/11
2/29/12
4/29/12
6/28/12
8/27/12
10/26/12
Level (in)
Rainfall (in)
12 inches Below Soil Surface
Growing Season
Date


Sandy Creek Gauge C
10
0
-10
-20
-30
-40
-50
5
4
3
2
1
0
11/1/11
12/31/11
2/29/12
4/29/12
6/28/12
8/27/12
10/26/12
Level (in)
Rainfall (in)
12 inches Below Soil Surface
Growing Season
Date

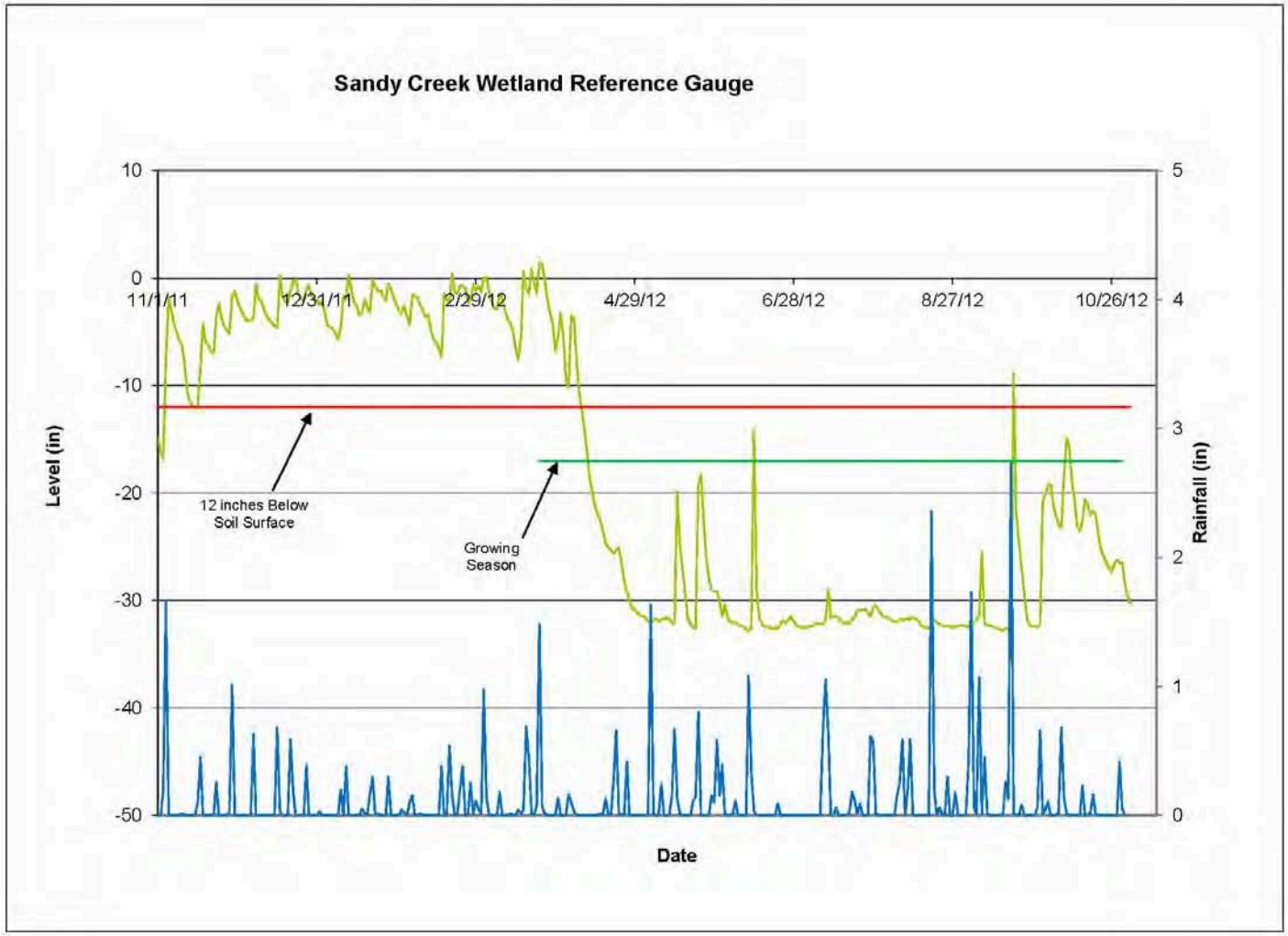

Sandy Creek Wetland Reference Gauge
Level (in)
Rainfall (in)
Date
10
0
-10
-20
-30
-40
-50
5
4
3
2
1
0
11/1/11
12/31/11
2/29/12
4/29/12
6/28/12
8/27/12
10/26/12
12 inches Below Soil Surface
Growing Season

Table 13. Wetland Criteria Attainment 2010-2012

	2010 (MY-03)			2011 (MY-04)			2012 (MY-05)		
Gauge #	**Max # Consecutive Days**	**% Growing Season**	**Success Criteria Attained**	**Max # Consecutive Days**	**% Growing Season**	**Success Criteria Attained**	**Max # Consecutive Days**	**% Growing Season**	**Success Criteria Attained**
Ref	6 [a]	3%	No	29	13%	Yes	16	7%	No
A	31 [b]	14%	Yes	62	28%	Yes	58 [d]	26%	Yes
B	21	9%	Yes	36	16%	Yes	33 [e]	15%	Yes
C	7 [c]	3%	No	38	17%	Yes	20	9%	No

a – Gauge installed 6/15/2010 – groundwater level monitored for 139 days of the growing season
b - Gauge installed 6/25/2010 – groundwater level monitored for 129 days of the growing season
c – Gauge installed 6/14/2010 – groundwater level monitored for 140 days of the growing season
d - Gauge malfunction – groundwater level monitored for 203 days of the growing season
e - Gauge malfunction – groundwater level monitored for 167 days of the growing season

Growing Season: March 24 to November 1 (222 days)
(http://www.wcc.nrcs.usda.gov/ftpref/support/climate/wetlands/nc/37063.txt)