The Catena Group

410-B Millstone Drive
Hillsborough, NC 27278
(919) 732-1300

July 1, 2011

Mr. Greg Melia, Stream Monitoring Supervisor
NCDENR Ecosystem Enhancement Program
2728 Capital Blvd.
Raleigh, NC 27604

RE: Sandy Creek MY-05 2010 Monitoring Report, Mary's Creek and Cane Creek: 2009 Annual Monitoring Report - Year 3

Dear Mr. Melia,

Enclosed please find three copies of the Final Sandy Creek MY-05 2010 Monitoring Report. Please feel free to contact me with any questions or comments. As such, my mobile phone is (919-417-2732) and my email address is csheats@thecatenagroup.com.

Sincerely,

Chris M. Sheats

Chris Sheats
Environmental Biologist

SANDY CREEK

Durham County, North Carolina
EEP Project No. 322

2010 Annual Monitoring Report
(Measurement Year-5 - MY5 (2010) – 1st year post-repair)
Site Constructed 2003/Repaired 2008-2009

June 10, 2011

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

TABLE OF CONTENTS

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. There is an additional 7.1 acres of existing wetlands within the conservation easement. Construction originally took place in 2003 entailing stream enhancement that involved the installation of log vanes to create pool features that will enhance habitat and water quality along 2,461 linear feet of stream. In 2004, the site was partially replanted due to low plant survivorship. 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.

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 wetland woody and herbaceous 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

Wetland maintenance activities conducted in December 2009 involved the removal of vegetation where vegetation monitoring plots 2, 3, and 4 were located, leaving only vegetation monitoring plot 1 intact. The site was replanted and plots 2, 3, and 4, were re-established in February 2010. Level I of the CVS-EEP protocol was administered for plots 2, 3, and 4 for Monitoring Year (MY)-05, which accounts for planted stems only. Vegetation monitoring plot 1 was not replanted therefore it remained in place where it was originally established in 2004. Level II of the CVS-EEP protocol was administered for plot 1 which includes planted and natural stems. As of the August of 2010, including all four monitoring plots, there were 242 planted stems/acre and 333 stems/acre including natural and planted stems. The success criterion for planted woody species is 320 stems/acre after MY-03. A mortality rate of ten percent will be allowed after MY-04 (288 stems/acre), with another ten percent allowed after MY-05 (260 stems/acre). The primary reason for low plant survivorship in 2010 was due to abnormally wet conditions in the Spring 2010 resulting in long periods of standing water that essentially drowned to newly installed plants before plantings could get established. Soil conditions at the site were improved with the addition of topsoil during the wetland maintenance activities. Due to a high mortality rate of the plantings installed in January 2010, the contractor was required to replant the site in March 2011. Planted stems were

marked with flagging and counted for each plot in order to accurately monitor survivorship for MY-06. Currently all plots are meeting success criteria.

Invasive exotic species on site include several stands of Chinese lespedeza (*Lespedeza cuneata*), observed along the woodland margins and within vegetation monitoring plot 1. These areas were not disturbed during the wetland maintenance activities conducted between December 2009 and February 2010.

1.3 Stream Assessment

The log vanes in Sandy Creek were evaluated for stability and effectiveness. Structurally, the site looks increasingly stable. The stream banks exhibit very little degradation and are stable and vegetated for the majority of the stream. There are a few areas where debris has collected that is creating minor bank erosion. Most of the log vanes were located and photographed. Some log vanes appear to have been covered by sediment. Photographs were also taken of the debris areas.

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. There are data gaps from March to June 2010 for the reference gauge, gauge A, and gauge C. A complete growing season dataset was only collected from gauge B. Gauge B did exhibit saturation within 12 inches of the ground surface for more than 12.5% of the growing season. The average annual growing season for Durham County is 227 days (March 30 - November 11). Groundwater data for a complete growing season for all gauges will be available from the 2011 growing season and will be provided in the 2011 Monitoring Year 6 Report.

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 1.2.1 2009). Stream assessments followed methodologies outlined in *Applied River Morphology* (Rosgen 1996). Levels 1 and 2 of the CVS-EEP vegetation monitoring protocol was followed for all vegetation assessments (Lee et al. 2006). Precipitation data were obtained from the State Climate Office of North Carolina (http://www.nc-climate.ncsu.edu/services/request.php). *Flora of the Carolinas, Virginia, Georgia, and surrounding areas* was the taxonomic standard used throughout data collection (Weakley 2011).

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 (http://cvs.bio.unc.edu/methods.htm)

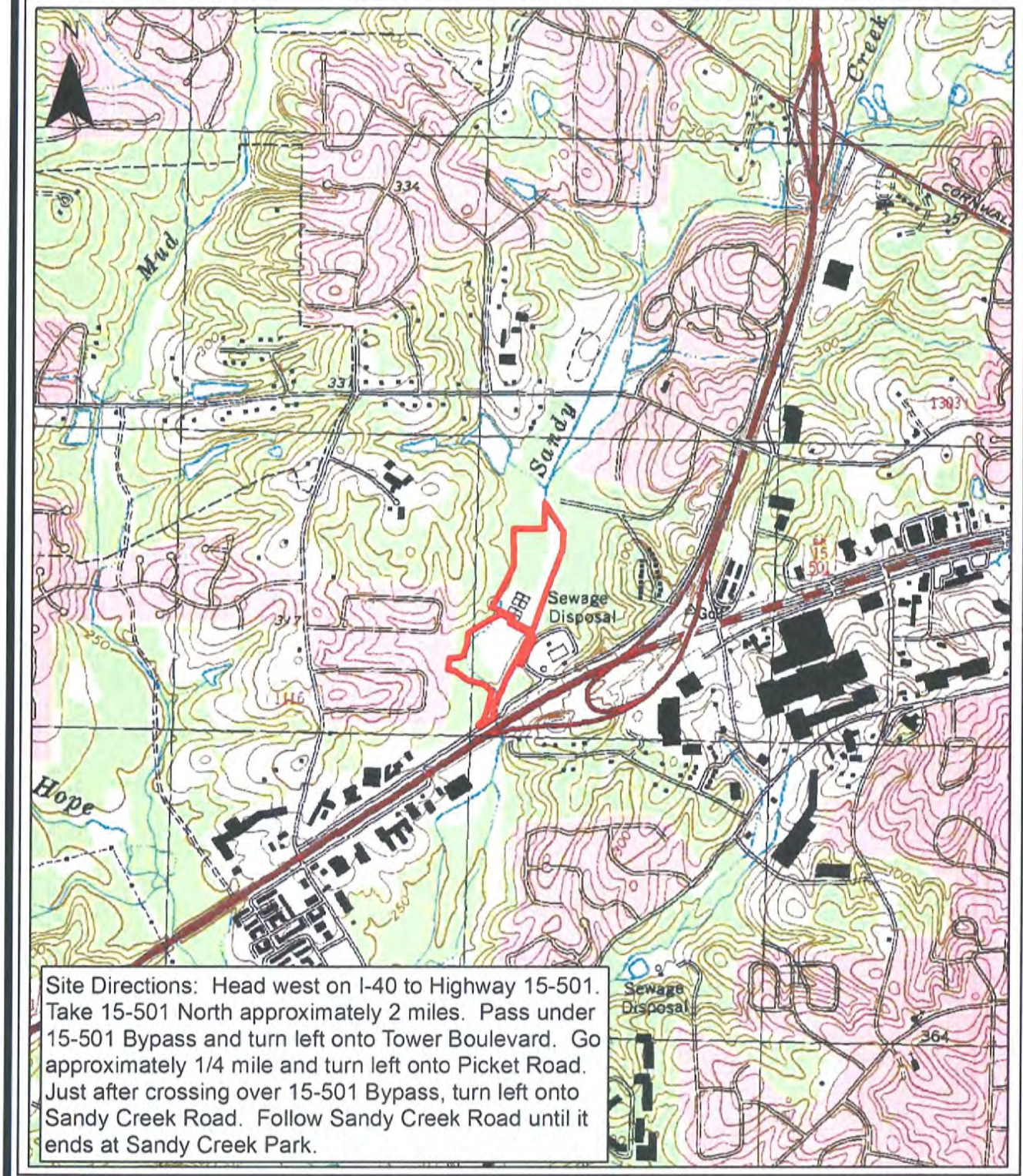
Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, CO.

State Climate Office of North Carolina 2010. North Durham Water Reclamation Facility Precipitation Data (*Nov. 1, 2009 – Nov. 1, 2010 Daily Totals*)

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

General Figures and Plan Views



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 1/4 mile and turn left onto Picket Road. Just after crossing over 15-501 Bypass, turn left onto Sandy Creek Road. Follow Sandy Creek Road until it ends at Sandy Creek Park.

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Sandy Creek: Wetland Restoration and Stream Enhancement Proiect

Vicinity Map

EEP Project No. 322

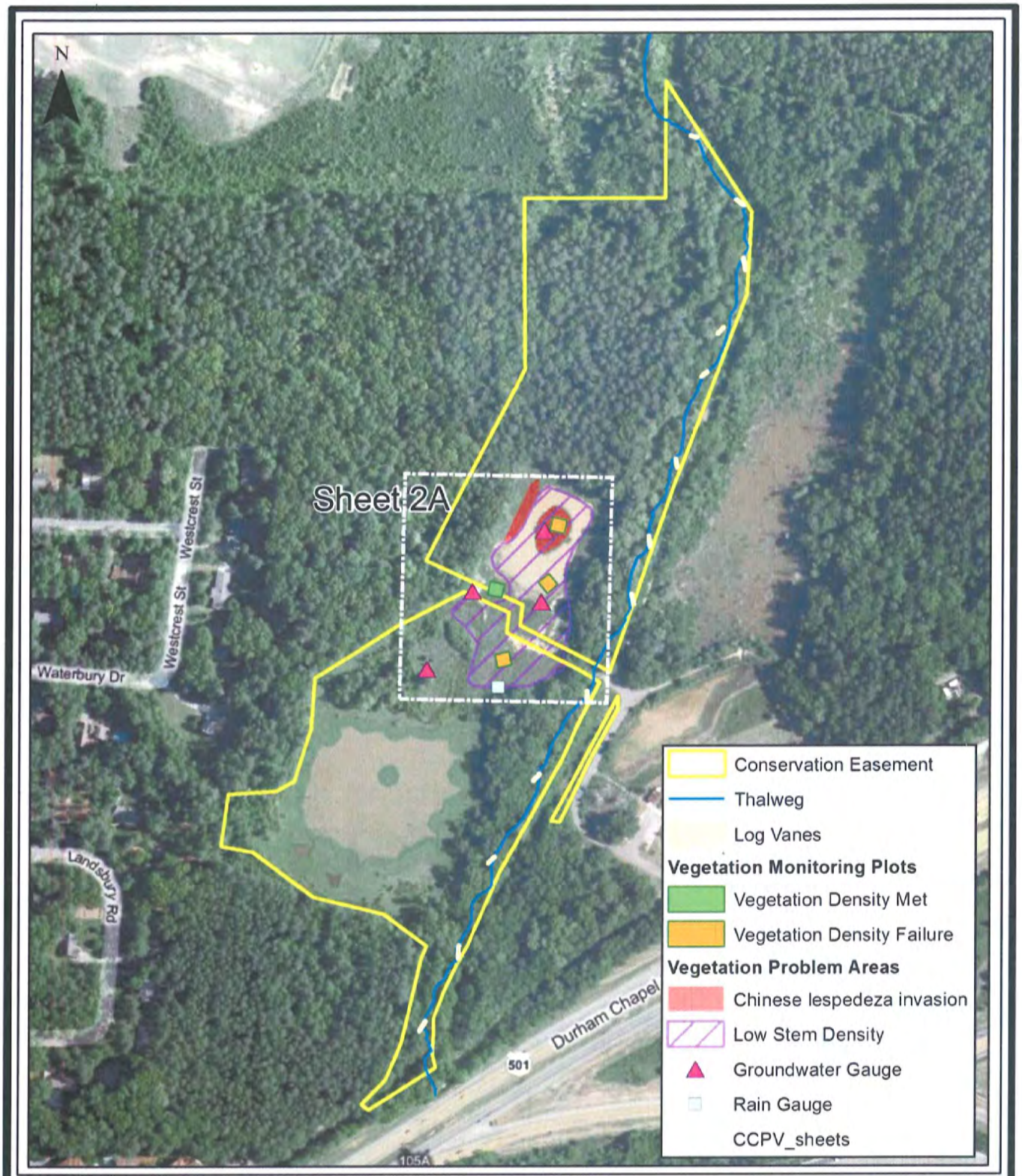
Durham County, North Carolina

Date: November 2010

Scale 0 500 1,000 Feet

Job No.: 4134

Figure 1



The Catena Group

Sandy Creek: Wetland Restoration and Stream Enhancement Proiect

CCPV Sheet Index

EEP Project No. 322

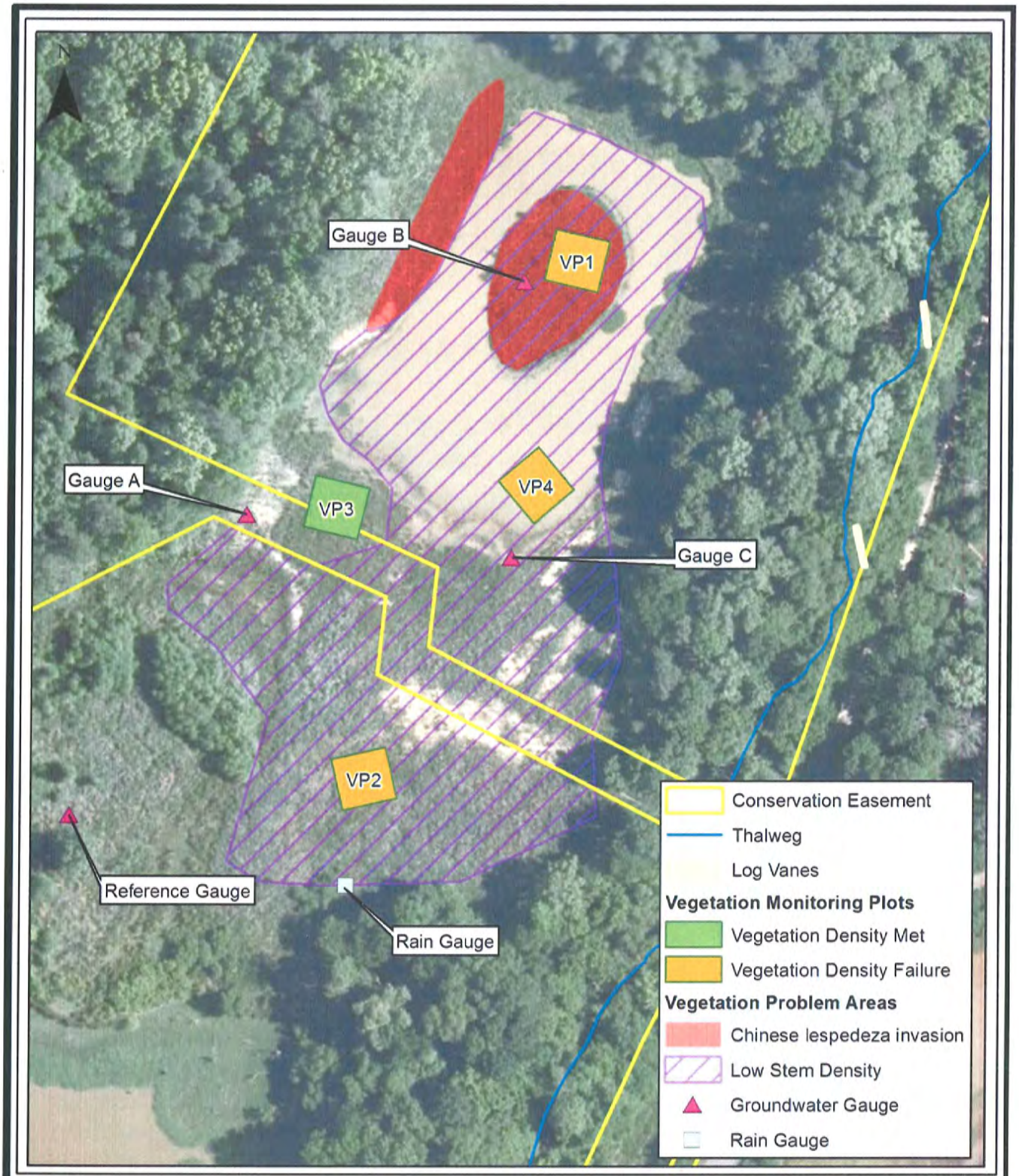
Durham County, North Carolina

Date: November 2010

Scale 0 100 200 Feet

Job No.: 4134

Figure 2



The Catena Group

Sandy Creek: Wetland Restoration and Stream Enhancement Proiect
CCPV
EEP Project No. 322
Durham County, North Carolina

Date: November 2010

Scale 0 25 50 Feet

Job No.: 4134

Figure 2A

Appendix B

General Project Tables

Table 1. Project Restoration Components

Exhibit Table 1. Project Mitigation Objectives and Structure 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	SBS	2,461 linear feet	00+00 to 27+00	Primarily achieved with placement of log vanes
Wetland Restoration	R	~	3.13 acres	N/A	

* EII = Enhancement II, R = Restoration. ** SBS = Stream Bank Stabilization

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

Table 2. Project Activity and Reporting History

Exhibit Table II. Project Activity and Reporting History Sandy Creek Stream Enhancement and Wetland Restoration Site / EEP Project No. 322			
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

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.

Table 3. Project Contacts Table

Exhibit Table III. Project Contacts 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: Brunton 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 Attribute Table

Exhibit Table IV. Project Background 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 C

Vegetation Assessment Data

Table 5. Vegetation Plot Success Summary Table

Exhibit Table X. Wetland Criteria Attainment Sandy Creek Stream Enhancement and Wetland Restoration Site / EEP Project No. 322		
Vegetation Plot ID	**Vegetation Density Met? (260 stems/acre)**	**Tract Mean**
P1	No	0%
P2	No	
P3	Yes	
P4	No	

Vegetation Monitoring Plot Photos

Photo 1. Vegetation Monitoring Plot 1.

Photo 2. Vegetation Monitoring Plot 2.

Photo 3. Vegetation Monitoring Plot 3.

Photo 4. Vegetation Monitoring Plot 4.

Table 6. Vegetation Metadata Table

Report Prepared By	Chris Sheats
Date Prepared	10/20/2010 17:36
database name	Sandy Creek CVS MY05COPY.mdb
database location	C:\Documents and Settings\chris\Desktop
computer name	TOSHIBA-USER
file size	38248448
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	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	7

Table 7. Stem Count and Planted by Plot and Species

Sandy Creek/EEP # 322			Current Plot Data (MY5 2010)												Annual Means					
			322-01-0001			322-01-0002			322-01-0003			322-01-0004			MY5 (Oct. 2010)			MY5 (Feb. 2010)		
Scientific Name	Common Name	Species Type	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T
Acer negundo var. negundo	boxelder	Tree			2												2			
Alnus serrulata	hazel alder	Shrub Tree																	1	1
Betula nigra	river birch	Tree											1	1		1	1		1	1
Carpinus caroliniana	American hornbeam	Shrub Tree																	5	5
Carpinus caroliniana var. caroliniana	Coastal American Hornbeam	Shrub Tree					1	1					1	1		2	2			
Cephalanthus occidentalis	common buttonbush	Shrub Tree								1	1		1	1		2	2		2	2
Cornus amomum	silky dogwood	Shrub								1	1					1	1		2	2
Fraxinus pennsylvanica	green ash	Tree					4	4								4	4		4	4
Nyssa sylvatica	blackgum	Tree								1	1					1	1		3	3
Platanus occidentalis	American sycamore	Tree																	6	6
Platanus occidentalis var. occidentalis	Sycamore, Plane-tree	Tree					1	1					1	1		2	2			
Quercus	oak	Shrub Tree			1												1		7	7
Quercus lyrata	overcup oak	Tree								1	1					1	1			
Quercus phellos	willow oak	Tree								3	3					3	3			
Robinia pseudoacacia	black locust	Tree			2												2			
Rosa palustris	swamp rose	Shrub																	1	1
Salix nigra	black willow	Tree		6	6								1	1		7	7		1	1
Ulmus	elm	Tree			4												4			
		Stem count	0	6	15	0	6	6	0	7	7	0	5	5	0	24	33	0	33	33
		size (ares)		1			1			1			1			4			3	
		size (ACRES)		0.02			0.02			0.02			0.02			0.10			0.07	
		Species count	0	1	5	0	3	3	0	5	5	0	5	5	0	10	14	0	11	11
		Stems per ACRE	0	242 .81	607 .03	0	242 .81	242 .81	0	283 .28	283 .28	0	202 .34	202 .34	0	242 .81	333 .87	0	445 .15	445 .15

Appendix D

Stream Assessment Data

Stream Station Photos

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

August 20, 2010

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

August 20, 2010

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

August 20, 2010

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

August 20, 2010

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

August 20, 2010

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

August 20, 2010

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

August 20, 2010

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

August 20, 2010

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

August 20, 2010

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

August 20, 2010

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

August 20, 2010

Photo Station 12: Log Vane #12 (Station 24 + 20)

August 20, 2010

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

August 20, 2010

Photo Station 14: Permanent Cross-Section (18 + 25) Viewed Looking Downstream

August 20, 2010

Table 8. Visual Morphological Stability Assessment

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

Table 9. Verification of Bankfull Events

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

Figure 3. Longitudinal profiles with annual overlays

Project	Sandy Creek/Project No. 322
Cross Section	Cross Section 1
Feature	Riffle
Station	18+25
Date	8/20/10
Crew	ZP, SV

Summary (bankfull)

	MY0	MY2	MY3	MY5
A (BKF)	109.6	114.7	119.7	110.5
W (BKF)	31.4	31.4	31.2	31.3
Max d	4.1	4.6	5.3	4.2
Mean d	3.5	3.7	3.8	3.5
WD	9.0	8.6	8.1	8.9

MY00-2003			MY02-2005			MY03-2006			MY05-2010		
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	LPIN
5.70	264.44		3.00	264.57		2.00	264.60		5.00	264.80	
8.00	264.20		5.00	264.66		4.00	264.69		8.00	264.56	TOBL
9.50	263.64	TOBL BKF	7.00	264.60	TOBL	6.00	264.78		9.00	263.86	BKF L
9.90	262.79		8.00	264.29		8.00	264.47	TOBL	10.00	262.72	
10.30	262.40		9.00	263.82	BKF L	8.70	264.24		11.50	261.58	
11.20	261.72		10.00	262.78		9.50	263.84	BKF L	12.60	260.06	TOE L
12.00	261.12		11.00	261.96		10.00	263.11		17.60	259.84	
12.20	260.07	Toe L	11.80	261.04		11.30	262.01		19.00	259.71	
13.00	259.97		12.00	259.54	Toe L	11.70	261.48		22.00	259.85	
14.00	259.99		15.00	259.49		12.40	260.37		23.00	259.75	
15.00	259.87		17.00	259.79		14.00	260.32		26.60	259.64	TW
16.00	259.83		21.00	259.82		18.00	260.49		31.00	259.93	
17.00	259.86		25.00	259.88		19.50	260.11		35.00	260.02	
18.00	259.83		31.00	259.77		23.00	260.00		37.20	259.75	TOE R
19.00	259.82		33.70	259.71		27.00	259.42		38.40	262.10	
22.00	259.60		35.00	259.51		32.00	258.82	TW	39.25	262.85	BKF R
23.00	259.72		35.70	259.37		36.00	258.66		40.40	263.97	
35.50	259.51	TW	37.00	259.27	TW	36.20	258.76	Toe R	41.30	264.41	TOBR
36.40	259.70		37.90	259.70	Toe R	39.00	262.32		44.00	264.52	
37.40	259.81	Toe R	38.70	262.01		41.00	264.13	TOBR	48.00	264.16	RPIN
38.40	260.96		39.60	263.09		43.00	264.47				
39.10	262.08		40.00	263.66		46.00	264.36				
39.70	262.64		41.00	264.11		48.00	264.19	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 Cross Section looking in the downstream direction

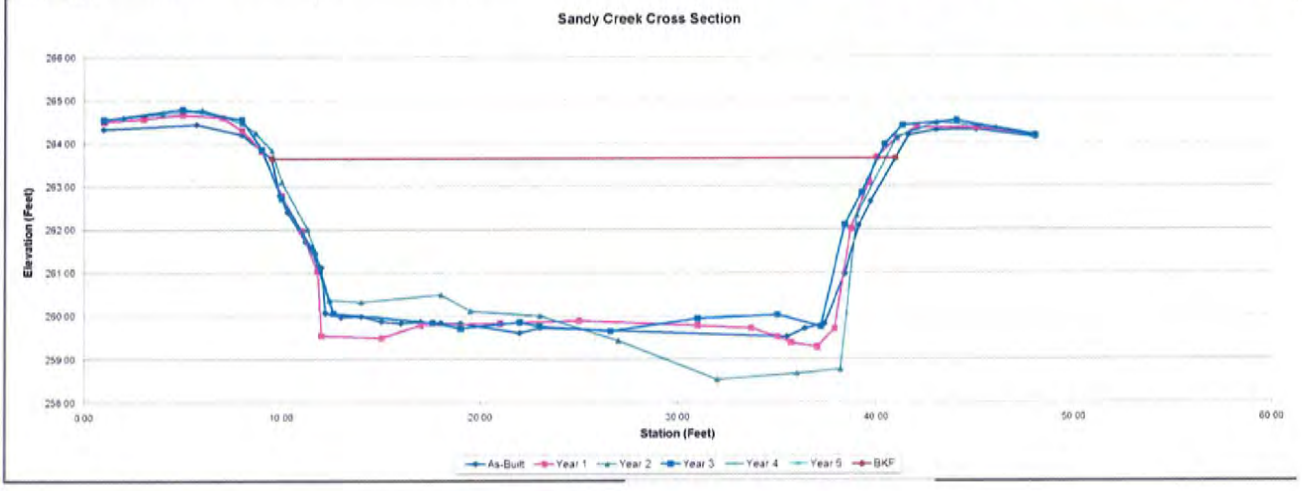


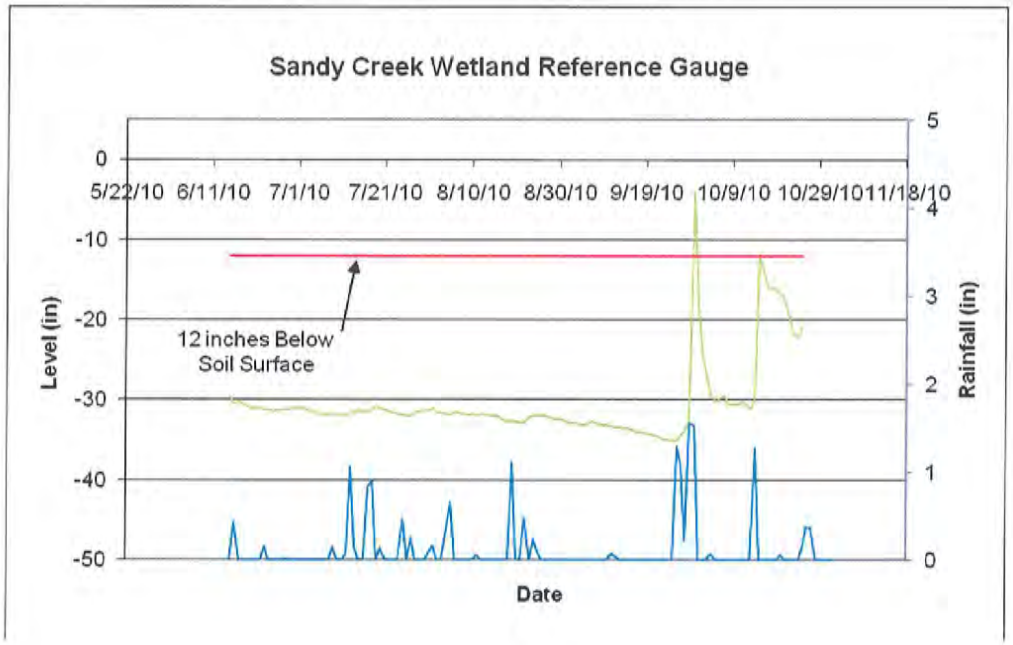
Figure 4. Pebble count plots with annual overlays

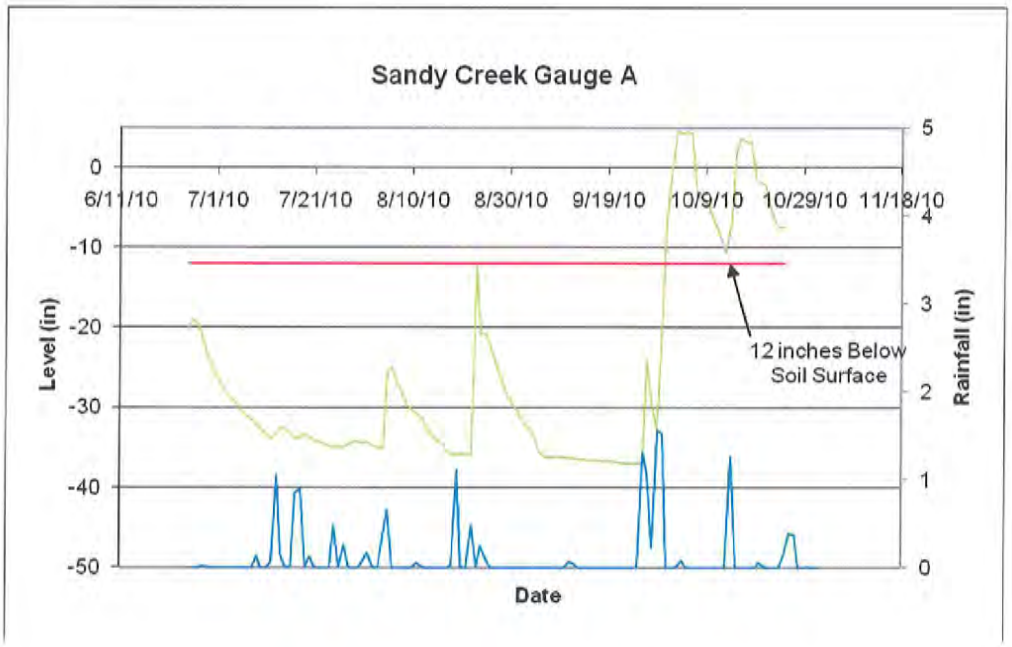
Not provided as project contains only stream enhancement via log vanes.

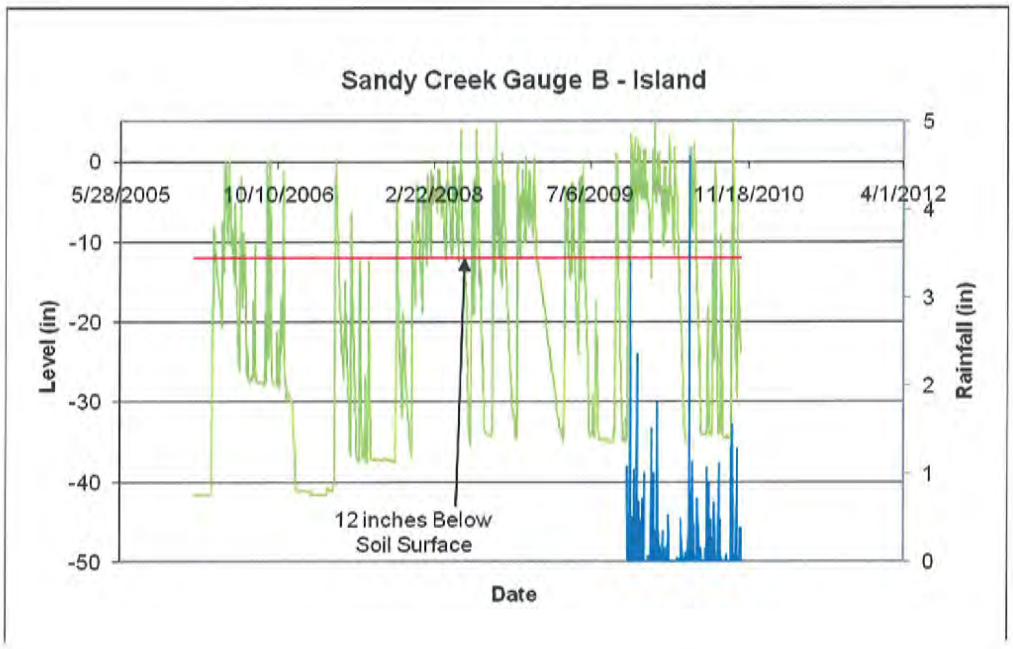
Appendix E

Wetland Assessment

Figure 5. Precipitation and Water Level Plots






Sandy Creek Gauge B - Island
0
-10
-20
-30
-40
-50
5/28/2005
10/10/2006
2/22/2008
7/6/2009
11/18/2010
4/1/2012
Level (in)
Rainfall (in)
5
4
3
2
1
0
12 inches Below
Soil Surface
Date

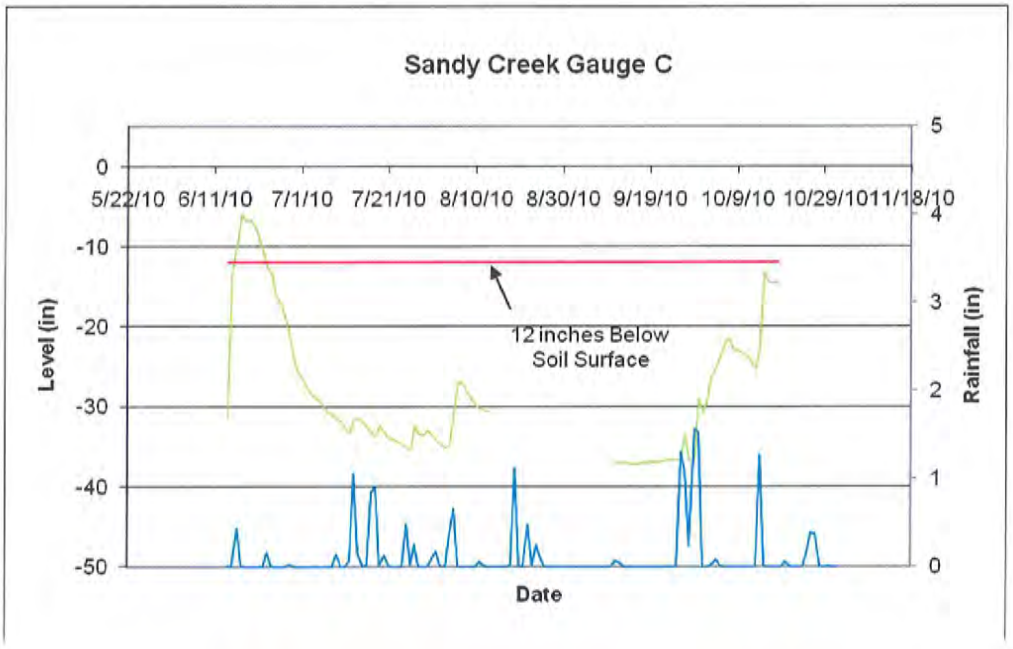

Sandy Creek Gauge C
0
-10
-20
-30
-40
-50
5/22/10
6/11/10
7/1/10
7/21/10
8/10/10
8/30/10
9/19/10
10/9/10
10/29/10
11/18/10
Level (in)
Rainfall (in)
5
4
3
2
1
0
12 inches Below
Soil Surface
Date

Table 10. Wetland Hydrology Criteria Attainment

Exhibit Table X. Wetland Criteria Attainment Sandy Creek / EEP Project No. 322			
Tract	**Well ID**	**Well Hydrology Threshold Met?**	**Tract Mean**
1	A	N/A*	N/A
1	B	yes	
1	C	N/A	
REF	Ref Site	N/A	

* N/A: Incomplete gauge data for 2010 growing season