Wilson Bay Wetland Restoration
Phase I
Jacksonville, Onslow County, North Carolina

2004 Annual Monitoring Report

Prepared for: NCDEHNR/Ecosystem Enhancement Program
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Ecosystem Enhancement PROGRAM

NCDENR

NC STATE UNIVERSITY

Wilson Bay Wetland Restoration Site – Phase I
Fall 2004 Monitoring Summary

A wetland restoration project was funded through the North Carolina Wetlands Restoration Program (NCWRP). The goals of the project are to:

1) Reduce nutrient and stormwater inputs to estuarine waters.
2) Stabilize shoreline through restoration of native vegetation.
3) Improve natural aesthetics of estuarine marsh.
4) Enhance wildlife habitat.
5) Educate visitors about the importance of coastal wetlands.

This is the 3rd year of the 5-year monitoring plan for the completed Wilson Bay Site.

Table 1. Background Information

Project Name	**Wilson Bay Wetland Restoration, Phase I**
Designer's Name	BLUE: Land, Water, Infrastructure, PA 1271 Old Highway #1 South Southern Pines, NC
Contractor's Name	Eastern Excavating, Inc. Jacksonville, NC
Directions to Project Site	Traveling east on Highway into Jacksonville, exist right to cross the old bridge into downtown. Turn right just past the courthouse. Drive south approximately one mile and turn left into the site at the old wastewater treatment plant.
Drainage Area	Not applicable
USGS Hydro Unit	03030001
NCDWQ Subbasin	03-05-02
Project Size	3 acres brackish marsh and transitional freshwater wetland restoration
Restoration Approach	Remove trash and debris. Mass earthwork, grading of wetland areas Creation of a tidal creek.
Date of Completion	Spring 2001
Monitoring Dates	November 2001, November 2003, November 2004

Results Summary

The site was found to be stable, ecologic communities developing, and vegetation healthy. Survivability and coverage is exceeding the success criteria for the site. The density and development of the marsh areas is substantial. Survivability and coverage of plants in the bay forest was meeting requirements. Willows and other freshwater wetland species that were not planted have exhibited fast growth in the past year. Continued monitoring should determine whether management measures are needed to control the spread of any undesirable species. Further development of communities at the site is expected and it appears that the goals of the site will be met without further work.

Table 2. Monitoring Results Summary Table

Wilson Bay Forest Quad 1

Tree Stratum

Species	Height (cm)	Diameter (mm)	Σ X-sec. (cm²)	Rel. x-sec (%)	Density	Rel. Density (%)	Rank (Importance)
Pinus serotina	350	21			6		1
	165	45					
	147	50					
	10	1					
	10	1					
	20	1					

Planted trees per acre	120
Trees per acre	240
Natural regeneration trees per acre	120

Shrub Stratum

Species	Cover (%)	Rel. cover (%)	Density	Rel. Density (%)	Rank (Importance)
Myrica cerifera	0.5	33.3	1	16.7	2
Ilex coriacea	1	66.7	5	83.3	1
Total	**1.5**	**100.0**	**6**	**100.0**	

Herb Stratum

Species	Cover (%)	Rel. cover (%)	Rank (Importance)
Ambrosia artemisiifolia	2	1.3	4
Aster sp.	2	1.3	4
Festuca sp.	60	38.5	2
Paspalum sp.	1	0.6	5
Distichlis sp.	80	51.3	1
Solidago sp.	10	6.4	3
Total	**155**	**99.4**	

Marsh Transect Data

Transect 1

Species	Plot No.	Count	Height (m)	Cover (%)
Spartina Cynosuroides	1	66	1.75-2	60
	2	52	1.75-2.25	50
	3	58	2-2.5	45
Spartina Patens	4	na	0.75	100

Transect 2

Species	Plot No.	Count	Height (m)	Cover (%)
Spartina Cynosuroides	1	54	2-2.5	50
Spartina Patens	4	na	0.75-1	100

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1.0 BACKGROUND DATA

1.1 Introduction

The Wilson Bay Wetland Restoration Project involved the restoration of brackish marsh and transitional freshwater wetlands. The site is located at the old wastewater treatment plant in Jacksonville, North Carolina. The plant is currently the site of an extensive retrofit/reuse project for the City of Jacksonville. The City plans to turn the plant into a museum, park, and educational center. Efforts at the site also include ecosystems restoration and research efforts in the surrounding watershed and in the adjacent Wilson Bay.

1.2 Goals and Objectives

The primary goals of the project were to:

1) Reduce nutrient and stormwater inputs to estuarine waters.
2) Stabilize shoreline through restoration of native vegetation.
3) Improve natural aesthetics of estuarine marsh.
4) Enhance wildlife habitat.
5) Educate visitors about the importance of coastal wetlands.

1.3 Design and Construction Background

Design and construction oversight services for this project were provided by Blue: Land, Water, Infrastructure, PA (BLWI). The construction bid was won by Eastern Excavating Inc., out of Jacksonville. The planting contract was awarded to Southern Landscaping, also from Jacksonville. Construction at the site began in early 2001 and planting of the site was completed later that spring. A number of wetland community types were planted including brackish marsh, salt shrub, gum-cypress swamp, and bay forest. Brackish marsh areas were planted primarily with *Spartina cynosuroides* (Giant Cordgrass) and *Spartina patens* (Saltmeadow Cordgrass). Other communities included a variety of native plantings appropriate for design elevation and water chemistry conditions.

1.4 Monitoring Background

A monitoring plan for the site including vegetative and hydrologic success criteria was prepared by BLWI. The plan submits vegetative criteria, which requires increasing percent coverage (based on plant spacing) over a 5 year period. Proposed minimums included 25% after the first year, 50% after the third year, and 75% after the fifth year. The hydrologic monitoring plan included analysis of groundwater levels and temperature to meet regulatory minimums.

The first monitoring visit was completed by Soil and Environmental Consultants, PA. The visit occurred on November 26, 2001, and monitoring focused on vegetative plots where survivability and height were measured. Plots were set up in a marsh reference area and the brackish marsh areas. A transect was set up in the bay forest. The report indicated that the site was meeting survivability requirements and stated that diversity and density at the site should continue to improve. However, the report noted several plots with low stem counts and some concern was mentioned about areas where crabgrass was growing.

Location Map

N

Wilson Bay
Wetland Restoration
Phase I

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Phone: 919.515.7637

WRRI
Water Resources Research Institue
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NCSU staff made our initial monitoring visit on October 1, 2003. This visit occurred 2 years after the first monitoring trip for the site. Our staff implemented a revised monitoring procedure developed based on the document "Draft Vegetation Monitoring Plan for NCWRP Riparian Buffer and Wetland Restoration Projects" provided by the North Carolina Wetlands Restoration Program. The new vegetation monitoring plan involved belted transects in the marsh areas and a plot in the bay forest area. The plan also involved analysis of hydrologic data recorded by a single groundwater gage in the bay forest area. Photographs and observations are also a part of the new monitoring agenda.

The 2003 monitoring found vegetative survivability and coverage to be exceeding the success criteria at this site. The density and development of the marsh area was found to be very impressive. Survivability and coverage of plants in the bay forest was meeting requirements. However, some signs of invasive and undesirable vegetation were found.

Recommendations from the 2003 monitoring included:

1) Continued monitoring of invasive and undesirable vegetation.
2) Potential addition of more tree species in the bay forest area.
3) Possible maintenance of invasive vegetation if competition appears to limit site development.

1.5 Current Monitoring

NCSU has continued monitoring throughout 2004. The monitoring methodology was kept the same as in 2003 and as described. Two site visits were conducted in 2004. The first, a spring visit, was made to collect water table data and make observations during the growing season. The second visit was conducted in the fall and involved the vegetative monitoring protocols.

2.0 MONITORING PLAN AND RESULTS

2.1 Vegetation Monitoring Set up

As described in the "Draft Vegetation Monitoring Plan for NCWRP Riparian Buffer and Wetland Restoration Projects" document, belted transects were set up for recording vegetation density and survivability in the marsh areas. A total of two (2) transects were set up that run perpendicular to the shoreline from the water edge to the upper limit of the restored marsh. 1 meter x 1 meter plots were set up at various intervals along the transects. Measurements were made in plots in the *Spartina cynosuroides* area and in the *Spartina patens* area for each transect. A single 10 meter x 10 meter plot was set up for measuring survivability of trees in the bay forest area. Smaller nested plots were set up within this plot. A 5 meter plot was set up for recording shrubs and a 1 meter plot was set up for herbaceous measurements. Other vegetative communities at the site were found to be too small to justify additional plots. However, our staff visited each area to make observations on the health and development of those communities.

Table 3. Vegetation Plots

Community Type	*Total Area (acres)*	*Setup*	*Plots*	*Size (sq. meters)*
Brackish Marsh	1.87	Transects	4	1m
Bay Forest	0.28	Nested Plots	1	10m, 5m, 1m

2.2 Vegetation Monitoring Results

2.2.1 Brackish Marsh

Observations in the restored marsh areas revealed a dense, healthy stand of the primary planted species. The density of *Spartina cynosuroides* made walking difficult and the average plant height was above the researcher's heads. Plot data in the *S. cynosuroides* areas resulted in a total of 230 stems in 4 plots for an average of 58 stems per plot. Although the overall average is slightly lower than in 2003 (65 stems/plot), the marsh may have already reached a near maximum stem count. *Spartina cynosuroides* ranged between 5.5 to 6.5 feet in height and covered between 35-60% of the plot surface area. Organic material buildup in most of the plots was around 0.5 inches. Marsh communities along the shoreline were more developed this year compared to 2003.

Development in the upper marsh areas planted with *Spartina patens* continued to be even more substantial than in the main marsh. Populations of *S. patens* were too dense to count every stem in the 1 meter plots. Plots in these areas were composed entirely of the desired species with no encroaching species found. A mat of old growth organic material between 6-8 inches thick covered the ground. New growth 2-2.5 feet in height covered 100% of the plot area.

Marsh areas throughout the site have exceeded survivability requirements as proposed in the monitoring plan for the site. Based on observations, the site is developing similarly to reference marsh area, although no reference measurements were made.

Monitoring Map

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Wetland Restoration
Phase I

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2.2.2 Bay Forest

A single monitoring plot was randomly located within the "Bay Forest" area. No reference area was studied; therefore no comparisons could be made to reference conditions. It should be noted that this area graded from drier, sandier conditions to wetter conditions toward the marsh.

Vegetation throughout the wetland appeared healthy and consisted of a combination of both planted trees and shrubs and volunteer shrubs and herbaceous plants. The wetland appeared to be going through an early successional stage despite the numerous planted shrubs and trees. This was evidenced by an abundance of *Andropogon glomeratus* throughout the area. Additionally, *Ambrosia artemisiifolia* (ragweed), *Aster* spp., and *Panicum* spp. were abundantly present within the plot, signifying early succession. *Myrica cerifera* (wax myrtle) and *Ilex coriacea* (gallberry) were the only shrubs recorded in the plot, although *Ilex glabra* (inkberry) and *Alnus serrulata* (tag alder) were located throughout. *I. coriacea* was the dominant shrub and appeared to be thriving throughout the entire site. Planted trees, including *Pinus serotina* (pond pine) and *P. palustris* (longleaf pine), were the only trees located in the plot vicinity. *P. serotina* was the dominant tree in the plot, with only three planted stems counted. Three volunteer species of the pine were also noted. Extrapolation gave a value of 120 planted trees per acre. No tree mortality was noted within the plot.

Natural regeneration included only herbaceous and shrub species. Surviving trees had been planted. However, a nearby seed source for pines is beginning to supply the site with volunteers. As stated, this site appears to be in an early successional state with shrub and herbaceous species thriving.

Invasive plant species on the site included a *Festuca* (fescue) species. *Festuca* sp. had been planted during the restoration phase for erosion control. The grass was quite healthy in areas where it was growing. The plant did not seem to be out competing native vegetation.

It appears that the vegetative success criteria, as proposed in the monitoring plan, for the freshwater wetland areas of the site are being met. As few tree species were planted, standard criteria based on stem counts per acre may not be met. However, it appears that most planted trees are surviving and a diverse population of shrubs and herbaceous plants is developing. Few of the smaller herbaceous plants planted at the site were found to have survived.

2.3 Hydrologic Monitoring Set up

A groundwater gage was installed in the bay forest area of the site. The gage was installed soon after construction activities were completed at the site. The gage is made by Remote Data Systems (RDS). The gage is set to record the water table depth once each day. Data download during the first monitoring visit was unsuccessful. Data downloads during the spring and fall visits in 2004 were both successful, and the data from 2003 was able to be retrieved.

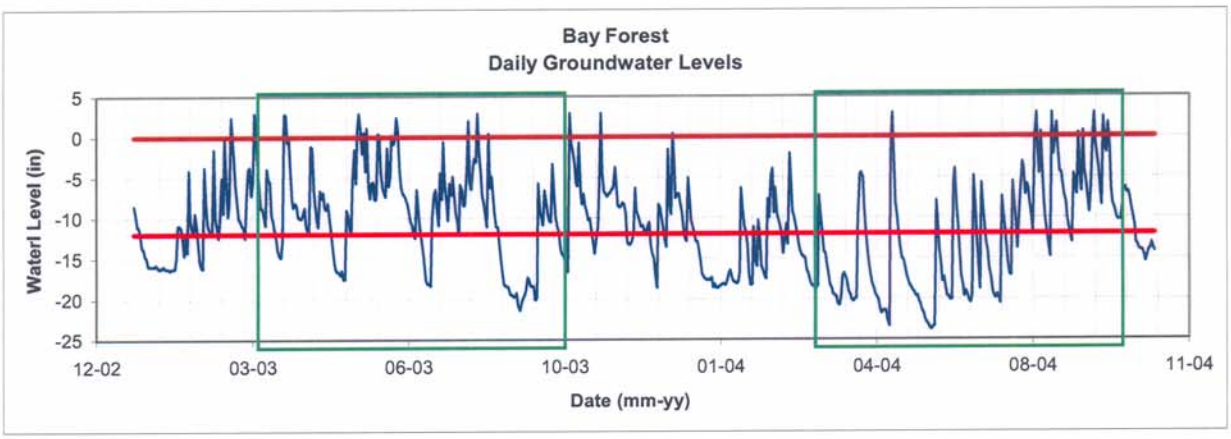


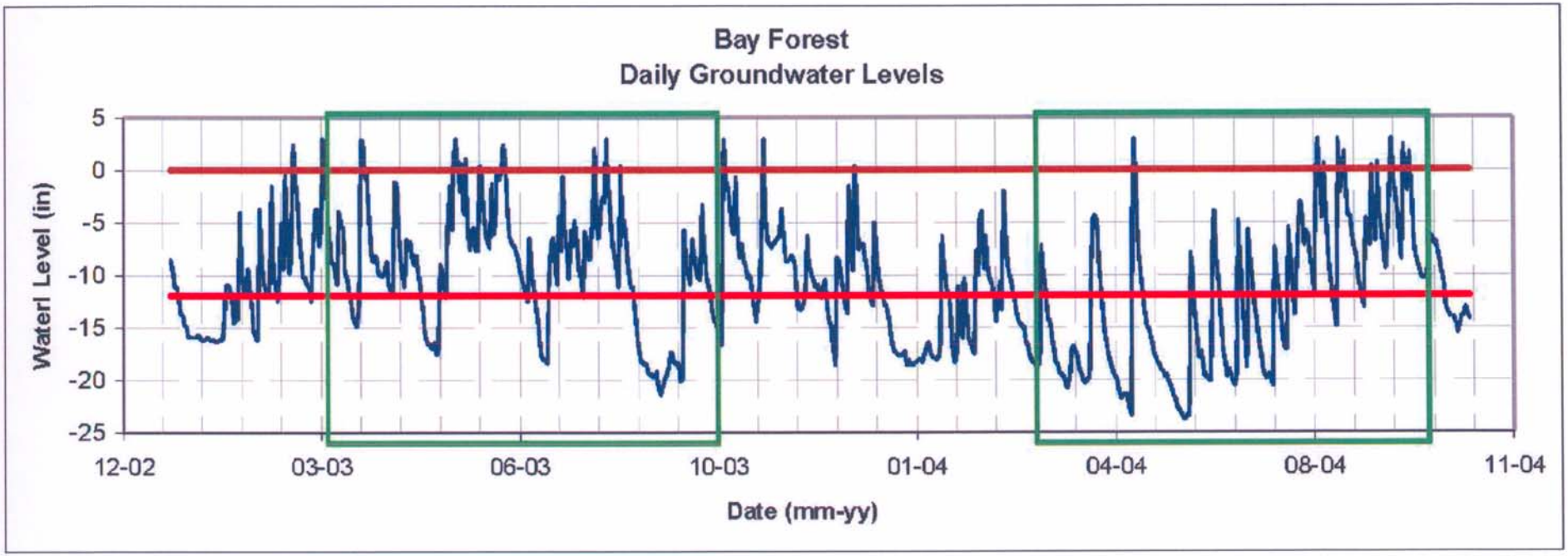
Figure 3. Bay Forest Groundwater Data

2.4 Hydrologic Monitoring Results

Figure 3 depicts water table depths in the Bay Forest area in the 2003 and 2004 growing seasons. The green boxes show the growing seasons, which are marked between March and October. General hydrologic criteria involve resulting groundwater levels within 12 inches of the surface for at least one period lasting 12.5% of the growing season. With the growing season beginning mid to late March and running through October, this would result in a period between 25-30 days. In both years, there were multiple periods during the growing season where the water table depth was within 12 inches of the surface. There were 7 periods ranging from 3-42 days in duration during 2003 and 9 periods ranging from 2-47 days in duration in 2004. Three periods in 2003 and one period in 2004 lasted longer than 25 days. It appears that the hydrology of this site is meeting the needs of the Bay Forest area and the planted woody vegetation.

2.5 Results Discussion

Vegetation survivability and coverage is exceeding the success criteria at this site. The density and development of the marsh areas was very impressive. Survivability and coverage of plants in the bay forest was meeting requirements. However, few of the smaller plants and herbs that were planted in this area were found to have survived. If a more diverse population of trees is desired, introduction of a few more species of trees may be recommended. Although undesirable vegetation does not appear to be outcompeting planted communities, the bay forest area should be watched to ensure that nutrients does do not become limited. If invasive plant populations become too competitive, some maintenance may be required. A small area where concentrated stormwater enters the site is developing as a freshwater wetland. The area is partly vegetated with what might be considered undesirable species such as willows and cattails. Although this is not part of the success criteria, expansion of this area could threaten the planned bay forest community. Observations in the salt shrub and gum-cypress swamp areas found the plants to appear healthy.


Bay Forest
Daily Groundwater Levels
Waterl Level (in)
5
0
-5
-10
-15
-20
-25
12-02
03-03
06-03
10-03
01-04
04-04
08-04
11-04
Date (mm-yy)

3.0 PHOTOGRAPHS

Photo 1. Marsh view from drying beds.

Photo 2. Marsh and Wilson Bay

Photo 3. Bay Forest Area.