

Carteret-Craven Electrical Cooperative
Wetland Restoration
Morehead City, Onslow County, North Carolina

2003 Annual Monitoring Report



Prepared for: NCDEHNR/Ecosystem Enhancement Program
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NC STATE UNIVERSITY

**Carteret-Craven Electrical Cooperative (CCEC)
Wetlands Restoration Site (Jumping Run Creek)
Fall 2003 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 inputs to estuarine system.
- 2) Contribute to effort to reopen closed shellfish waters.
- 3) Provide educational opportunities to show the importance of wetlands for water quality.

This is the 2nd year of the 5-year monitoring plan for the completed CCEC Site.

Table 1. Background Information

Project Name	Carteret-Craven Electrical Cooperative Wetlands Restoration Site (Jumping Run Creek)
Designer's Name	Soil and Environmental Consultants, PA. 11010 Raven Ridge Rd. Raleigh, NC 27614
Contractor's Name	East Cell – NC Department of Transportation West Cell - unreported
Directions to Project Site	The site is located at the Carteret-Craven Electrical Cooperative offices. The offices are located on the north side of NC-24, near Morehead City, NC.
Drainage Area	1.25 square miles
USGS Hydro Unit	03020106
NCDWQ Subbasin	03-05-03
Project Size	2.64 acres freshwater wetland restoration
Restoration Approach	Expand existing road ditches. Grade areas to improve hydrology. Utilize water control structure to improve storage in upper West Cell.
Date of Completion	East Cell - Fall 2000, West Cell – Winter 2001
Monitoring Dates	November 2002, November 2003

Results Summary

Overall, this site is currently meeting the proposed mitigation success criteria. However, there is some concern over the vegetative community development, especially in the West Cell of the site. Continued monitoring in this cell should determine if corrective actions are needed. Recommendations for this site include:

- 1) Continued monitoring of planted and invasive vegetation, particularly in the West Cell.
- 2) Soil testing and possible addition of amendments in the West Cell.
- 3) Additional planting of both herbaceous and woody trees in the West Cell.

Additional recommendations may be incorporated that may improve hydrology and the site's water quality benefit. These recommendations are not necessary to meet mitigation requirements. Suggestions are summarized in the Results Discussion section of the full report.

Table 2. Summary Table of Results

Carteret-Craven Electrical Coop. Wetland									
Morehead City, Onslow County, NC									
Fall 2003 Monitoring Data Summary									
10/2/2003									
East Cell Quad 1									
Tree Stratum									
Species	Stems	Height (cm)	Diameter (mm)	Radius (mm)	Σ X-sec. (mm²)	Rel. x-sec (%)	Density	Rel. Density (%)	Rank (Importance)
<i>Nyssa aquatica</i>	8	108.3	27.8	13.9	644.4	56.1	8.0	50.0	1
<i>Nyssa biflora</i>	1	74.0	21.0	10.5	346.4	3.8	1.0	6.3	3
<i>Taxodium distichum</i>	7	63.0	12.0	6.0	113.1		7.0	43.8	2
Trees per acre	640								
East Cell Quad 2									
Tree Stratum									
Species		Height (cm)	Diameter (mm)	Radius (mm)	Σ X-sec. (mm²)	Rel. x-sec (%)	Density	Rel. Density (%)	Rank (Importance)
<i>Nyssa aquatica</i>	12	116.7	28.6	14.3	680.1	45.9	12.0	38.7	2
<i>Pinus serotina</i>	5	39.6	9.4	4.7	72.1	2.0	5.0	16.1	3
<i>Taxodium distichum</i>	14	88.0	17.0	8.5	227.0	52.0	14.0	45.2	1
Trees per acre	1240								
West Cell Quad 1									
Tree Stratum									
Species		Height (cm)	Diameter (mm)	Radius (mm)	Σ X-sec. (mm²)	Rel. x-sec (%)	Density	Rel. Density (%)	Rank (Importance)
<i>Nyssa aquatica</i>	7	57.4	14.9	7.4	177.3	29.8	7.0	14.3	2
<i>Pinus taeda</i>	40	27.3	8.8	4.4	63.3	60.8	40.0	81.6	1
<i>Nyssa biflora</i>	1	89.0	20.0	10.0	314.2	7.5	1.0	2.0	3
<i>Chaemaecyparis thyoidea</i>	1	29.0	10.0	5.0	78.5	1.9	1.0	2.0	4
Total trees per acre	1960								
Planted trees per acre	360								
West Cell Quad 2									
Tree Stratum									
Species		Height (cm)	Diameter (mm)	Radius (mm)	Σ X-sec. (mm²)	Rel. x-sec (%)	Density	Rel. Density (%)	Rank (Importance)
<i>Nyssa aquatica</i>	3	48.0	13.7	6.8	152.1	10.1	3.0	21.4	2
<i>Pinus taeda</i>	2	38.5	12.0	6.0	141.4	6.3	2.0	14.3	3
<i>Taxodium distichum</i>	9	89.0	22.9	11.4	420.4	83.7	9.0	64.3	1
Total trees per acre	560								
Planted trees per acre	480								

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1.0 BACKGROUND DATA

1.1 Introduction

The project site is located on the grounds of the Carteret Craven Electrical Cooperative offices. There are two main areas of the site. One is located on the east side of the building and a larger area is to the west of the building. Background data provided in this report was provided in a report entitled "Monitoring Report for Carteret-Craven Electrical Cooperative Wetlands". The report was prepared by Soil and Environmental Consultants, PA (S&EC) and submitted on January 2, 2003. The primary goals of the project, as included in the report, were to restore freshwater wetlands on the site that had been destroyed by filling and drainage activities. The wetlands would provide water quality improvements and augment habitat in the area. The goals of the project as listed by the NCWRP on their website include:

- 1) Reduce nutrient inputs to estuarine system.
- 2) Contribute to effort to reopen closed shellfish waters.
- 3) Provide educational opportunities to show the importance of wetlands for water quality.

1.2 Design and Construction Background

Site design services were provided by S&EC. The site was constructed in two phases. The first phase consisted of construction on the eastern portion of the site. Grading for phase I was done by the North Carolina Department of Transportation (NCDOT). Construction at the site began in February of 2000 and planting was completed that summer. The second phase of construction on the site began in December of 2000. This phase of the construction was completed by a private contractor. This phase included the construction of a low head weir/bulkhead structure to control hydrology in the upper area of the site. The weir was installed during February of 2001. The west cell was planted in March and April of 2001. Some additional work was undertaken to improve conditions in the western cell in December of 2001. This work included plugging portions of the ditch, repair of erosion near the weir, and repair of damage caused by surface water flow down the banks of the wetland.

1.3 Monitoring Background

The initial success criteria for the site focused on survivability of canopy tree species and groundwater hydrology. Vegetative success consisted of meeting a 260 stems per acre survival of tree species. The species also must be at least 50% hydrophytic, meeting the categories of OBL, FACW, or FAC. The hydrologic success required that groundwater levels meet saturation for a continuous period at least 8.75% of the duration of the growing season. The duration of 8.75% was chosen because it is halfway between the minimum of 5% and the general accepted value of success at 12.5%. Using soil survey climatic information, S&EC determined the required inundation length to be 21 days during the growing season. The growing season would be determined with local weather data, and additional analysis would be undertaken if records indicate a less than average year of rainfall.

The first monitoring trip made to the site was on November 21, 2002 by S&EC. Three 10 meter X 10 meter plots were set up for vegetative sampling. One plot was set up in the eastern cell and two were installed in the west cell. In the west cell, one of the plots was set up above the weir and one between the weir and the road. Woody vegetation was identified and counted in each of the cells. No effort was made to distinguish between planted and volunteer vegetation. The presence and percent coverage of herbaceous vegetation was also noted in the plots. The results presented in the monitoring report indicate an average density of 946 stems/acre. This number reflects the total of all of the plots. Observations report 80% cover in the eastern cell, with much lower coverages in the western cell at 20% and 30%. The results of this vegetative survey indicate survival well above the required minimums.

Three groundwater gages had been installed to monitor hydrology at the site. The report determined that groundwater levels during the growing season of 2002 were within 12 inches of the surface for continuous periods greater than 21 days. The report also states that drought conditions occurred in this year, indicating that longer periods of saturation should be expected in years with normal rainfall.

1.4 Current Monitoring

NCSU staff made our initial monitoring visit on October 2, 2003. Our staff planned to implement 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 plan also involves analysis of hydrologic data recorded by groundwater gages in the wetland area. Photographs and observations will also be a part of the new monitoring agenda. The full monitoring plan is explained in detail in this report.

Location Map



CCEC
Jumping Run Creek
Wetlands Restoration



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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, the monitoring set up for this site was a series of nested plots. Two 1 meter X 1 meter plots were set up in each of the wetland cells. The plots were permanently marked with pipe so measurements can be replicated in subsequent years. Smaller nested plots were set up to record shrub and herbaceous cover. The attached Vegetation Monitoring map shows the locations of the vegetation transects and plots.

Table 3. Vegetation Plots

<i>Community Type</i>	<i>Total Area (acres)</i>	<i>Setup</i>	<i>Plots</i>	<i>Size (sq. meters)</i>
East Cell	0.82	Nested Plots	2	10m, 5m, 1m
West Cell	1.82	Nested Plots	2	10m, 5m, 1m

2.2 Vegetation Monitoring Results

2.2.1 East Cell

Vegetation throughout the East Cell appeared healthy and consisted of a combination of both planted trees and shrubs and volunteer shrubs and herbaceous plants. The herbaceous plants were widely diverse and thick throughout. A variety of algae was found in areas of standing water. Microtopography was heterogeneous in most areas.

Two random plots were assigned to this cell. Herbaceous vegetation consisted of a variety of emergent and terrestrial plants. *Hydrocotyle* spp. (Pennywort) and *Diodia virginiana* were dominant emergents. Rushes and sedges were common, but nowhere dominant. Few shrubs existed and those that were noted were small species of *Myrica cerifera* (wax myrtle), *Rosa palustris* (swamp rose) and *Cephalanthus occidentalis* (button bush).

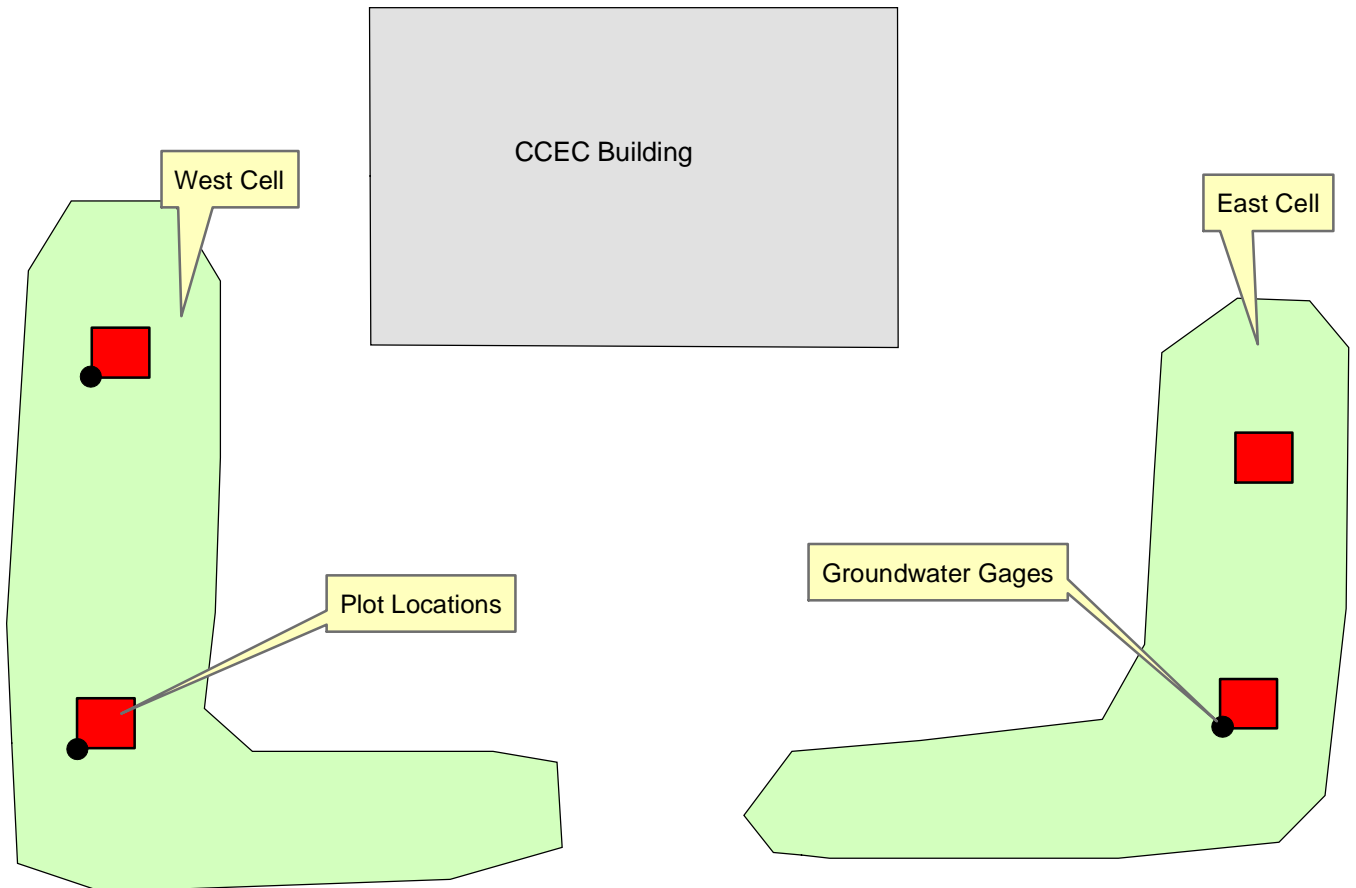
Planted trees were prevalent on this site. *Taxodium distichum* (bald cypress) and *Nyssa aquatica* (water tupelo) were the dominate trees. Planted trees were largely healthy and appeared vigorous. *Pinus serotina* (pond pine) was present, although unhealthy in appearance. Some tree mortality was noticed. Extrapolation from two plots in the East Cell resulted in an average of 940 trees per acre for this area. This number appears to be from planted trees only with little to no naturally regenerated trees noted.

Natural regeneration included only herbaceous and shrub species. Surviving trees had been planted. Planted wax myrtles along the wetland appeared to be an abundant seed source of these species.

Invasive plant species on the site included *Mikania scandens* (climbing hempweed) and *Typha* spp. (cattails). Although not exotic, these plants were present in the wetland. The climbing hempweed covered nearly every shrub and tree. This vine appeared to strangle smaller shrubs and cause irregular growth in the trees. Cattails were located in an isolated area along an outfall area near the road.

The east cell is currently meeting the requirements of vegetative success at this site. Recommendations for this site are to monitor the invasive plants over time and maintain them if needed. Overall, this portion of the site has a healthy, diverse vegetative population.

Monitoring Map



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2.2.2 West Cell

Vegetation throughout the West Cell consisted of a combination of both planted and volunteer trees, shrubs and herbaceous plants. The cell was divided by a rectangular weir. Two random plots were placed in this cell. One was located below the weir, and one above. The land area above the weir appeared to be less vegetated than the area below the weir. A variety of algae was found in areas of standing water. Both plot locations graded from drier areas to wetter (standing water) areas.

Herbaceous vegetation consisted of a variety of emergent and terrestrial plants. *Hydrocotyle* spp. and *Diodia virginiana* were dominant emergents in the area below the weir. The plot above the weir was very sparse in herbaceous vegetation and compared to the East Cell, diversity of herbs was low in the West Cell. Only small species of wax myrtle represented the shrub layer. These appeared to be volunteers from a nearby hedgerow. A few unidentifiable dead shrubs were noted. In both areas, the shrub and herb layer was more abundant in the drier areas than the wetter areas.

Planted trees on this site included predominantly bald cypress and water tupelo with a few *Chamaecyparis thyoides* (Atlantic white-cedar) and *Nyssa biflora* (Swamp tupelo) scattered around. The overall health of these trees was poor, particularly those in the standing water areas and those in the location above the weir. The area below the weir was abundant in *Pinus* spp. volunteers, which were healthy and vigorous. Extrapolation from two plots in the West Cell resulted in an average of 420 planted trees per acre for this area. Planted trees and volunteer trees resulted in an extrapolated average of 1260 trees per acre.

Invasive plant species on the site included climbing hempweed. These plants were present in the drier areas of this wetland. This vine appeared to strangle smaller shrubs and cause irregular growth in the trees in the drier areas. It is not nearly as prevalent as it is in the East Cell.

Currently, this portion of site is meeting the mitigation success criteria. However, there is some concern about the continued survival of desired species in this cell. Recommendations for this site are to monitor the invasive plants over time and maintain them if needed. Secondly, a soil fertility test is recommended. The substrate appeared to be quite sandy, and given the poor health of the planted trees, may be lacking in nutrients. The site would probably benefit from the addition of more planted trees.

2.3 Hydrologic Monitoring Setup

Three ground water gages were set up at the site for the purposes of hydrologic monitoring after the project construction was completed. No revisions to the current hydrologic monitoring plan were proposed for this site. The data from each of the devices was downloaded during the monitoring visit. Analysis and overlay of the data showed that saturation levels well exceeded the mitigation requirements. Water levels in each area were recorded above the ground surface for much of the growing season and the water level never dipped past 12 inches below the surface (Figure 2).

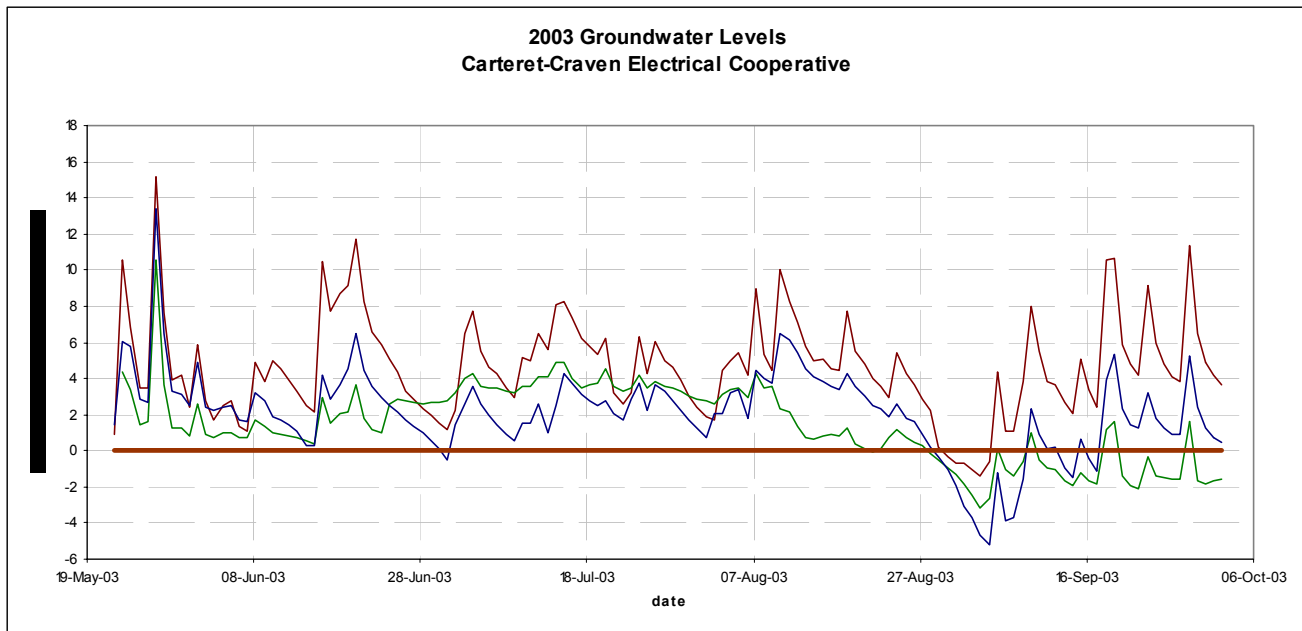


Figure 3. 2003 Groundwater Levels

2.4 Results Discussion

The Carteret-Craven Electrical Cooperative is currently meeting the vegetative and hydrologic success criteria for the project. Stem counts and saturation levels are well above the proposed criteria. However, there are some concerns with tree mortality and invasives, especially in the West Cell of the site. Continued monitoring is recommended to further assess whether actions will be needed to ensure future vegetative criteria will be met and that invasives will not negatively impact the area. A soil fertility test is recommended to determine if nutrient deficiencies are a problem in the West Cell.

Although water levels appear to be sufficient in the wetland, observations indicate that some short-circuiting of the wetland is occurring due to a ditch along the edge of the West Cell. Filling of this ditch or the installation of targeted channel plugs would probably improve hydrologic cycling and the water quality benefits of the wetland. The continued level of surface inundation may also be causing stress and contributing to the poor health and propagation of the trees. This type of hydroperiod, which is more similar to a constructed wetland than a natural one, may be more suitable for herbaceous wetland plants. If maximizing water quality benefits is a primary goal of the project, it may be recommended to compliment the Western Cell with a herbaceous planting. Regrading of the ditch area and installation of some higher microtopographic areas could also have a benefit. Higher areas could be replanted with desirable trees.

3.0 PHOTOGRAPHS



Photo 1. East Cell



Photo 2. East Cell Vegetation Plot



Photo 3. West Cell - above weir



Photo 4. West Cell - groundwater gage



Photo 5. Pitcher Plants found at the site