Wilson Bay (Sturgeon City) Wetland Restoration
Phase I
Jacksonville, Onslow County, North Carolina

2005 Annual Monitoring Report
Year 5 of 5

NCEEP Project Number: .00090
BLWI Project Number: 050038
NCDENR contract: D05056S

Prepared for:	NCDENR Ecosystem Enhancement Program 1652 Mail Service Center Raleigh, NC 27699
Prepared by:	BLUE: Land, Water, Infrastructure, PA 1271 Old US Highway #1 South Southern Pines, NC 28387
Original Design Firm:	BLUE: Land, Water, Infrastructure, PA 1271 Old US Highway #1 South Southern Pines, NC 28387

17 February 2006

Ecosystem Enhancement PROGRAM

BLUE Land Water Infrastructure

Contents

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Appendix A - Photos

I. **Executive Summary**

The Wilson Bay (Sturgeon City) Wetland Restoration Phase I is located at Sturgeon City in Jacksonville, NC. It is adjacent to abandoned drying beds at the inactive municipal wastewater treatment plant. The project was a cooperative effort between the City of Jacksonville and the NC Ecosystem Enhancement Program (formally the NC Wetlands Restoration Program). This project removed trash laden fill material from a former wetland area and restored approximately 1.90 acres of brackish marsh, 0.28 acres of a bay forest wetland, 0.07 acres of cypress-gum wetland fringe, 0.46 acres of salt shrub fringe and 415 linear feet of associated tidal creek. The site was planted in the year 2001. This report represents the fifth year of the monitoring period, but only the fourth year for formal reported monitoring. The project was not designed to meet any specific mitigation requirements.

Monitoring requirements for the site, vegetative and hydrologic, are the basis for determination of project success. Success in vegetative growth is based yearly comparisons. There is only one monitoring well in the bay forest to measure hydrologic success. Success is meeting the ACOE criteria for a wetland. Vegetative growth at the site is excellent in the brackish marsh and adequate in the bay forest and fringed wetlands. Development of associated organic mat also follows this trend. Volunteer native vegetation has been noted at the site. Undesirable species competition has not been observed to be an issue at this time. The observed hydrologic character of the site is meeting or exceeding the success criteria. The subsurface and surface water levels are exhibiting desirable trends for development and maintenance of the site vegetation and overall natural community.

The site is stable, desired natural communities are developing, and vegetation is healthy. Further development of communities at the site is expected and it appears that the goals of establishing a brackish marsh on the site will be met without further efforts.

II. Project background

A. Location and Setting

The project is located at Sturgeon City in Jacksonville, NC. It is adjacent to abandoned drying beds at the inactive municipal wastewater treatment plant.

Directions from Raleigh: Take I-40 East to Exit 373 - NC24/NC903 East. Follow NC 24 to Jacksonville. In Jacksonville, veer right onto Old Bridge Street to cross the New River. Turn right onto Court Street. The inactive municipal wastewater treatment plant is at the end of Court Street. Take a left into the inactive plant. The project area is adjacent to Wilson Bay at the far end of the property from the entrance. (Figure 1. Vicinity Map)

B. Structure and Objectives

The Wilson Bay (Sturgeon City) Wetland Restoration Phase I involved removal of trash laden fill material from a former wetland area, grading of the site to desired elevations, and planting the area with appropriate vegetation. The primary goals of the project were to: 1) reduce nutrient and stormwater inputs to estuarine waters; 2) stabilize the shoreline through restoration of native vegetation; 3) improve the natural aesthetics of estuarine marsh; 4) enhance wildlife habitat; and 5) educate visitors about the importance of coastal wetlands. The project was a cooperative effort between the City of Jacksonville and the NC Ecosystem Enhancement Program (formally the NC Wetlands Restoration Program). The project implementation was not required to meet any mitigation needs.

Exhibit Table I. Project Structure Table
Project Number and Name: 050038 Sturgeon City Phase I

Area	Acreage
Bay Forest wetland	0.28
Cypress Gum wetland fringe	0.07
Salt Shrub fringe	0.46
Brackish Marsh	1.90

Exhibit Table II. Project Objectives Table
Project Number and Name: 050038 Sturgeon City Phase I

Area	Objectives	Acreage	Comment
Bay Forest wetland	Buffer	0.28	
Cypress Gum wetland fringe	Buffer	0.07	
Salt Shrub fringe	Buffer	0.46	
Brackish Marsh	Restoration	1.90	

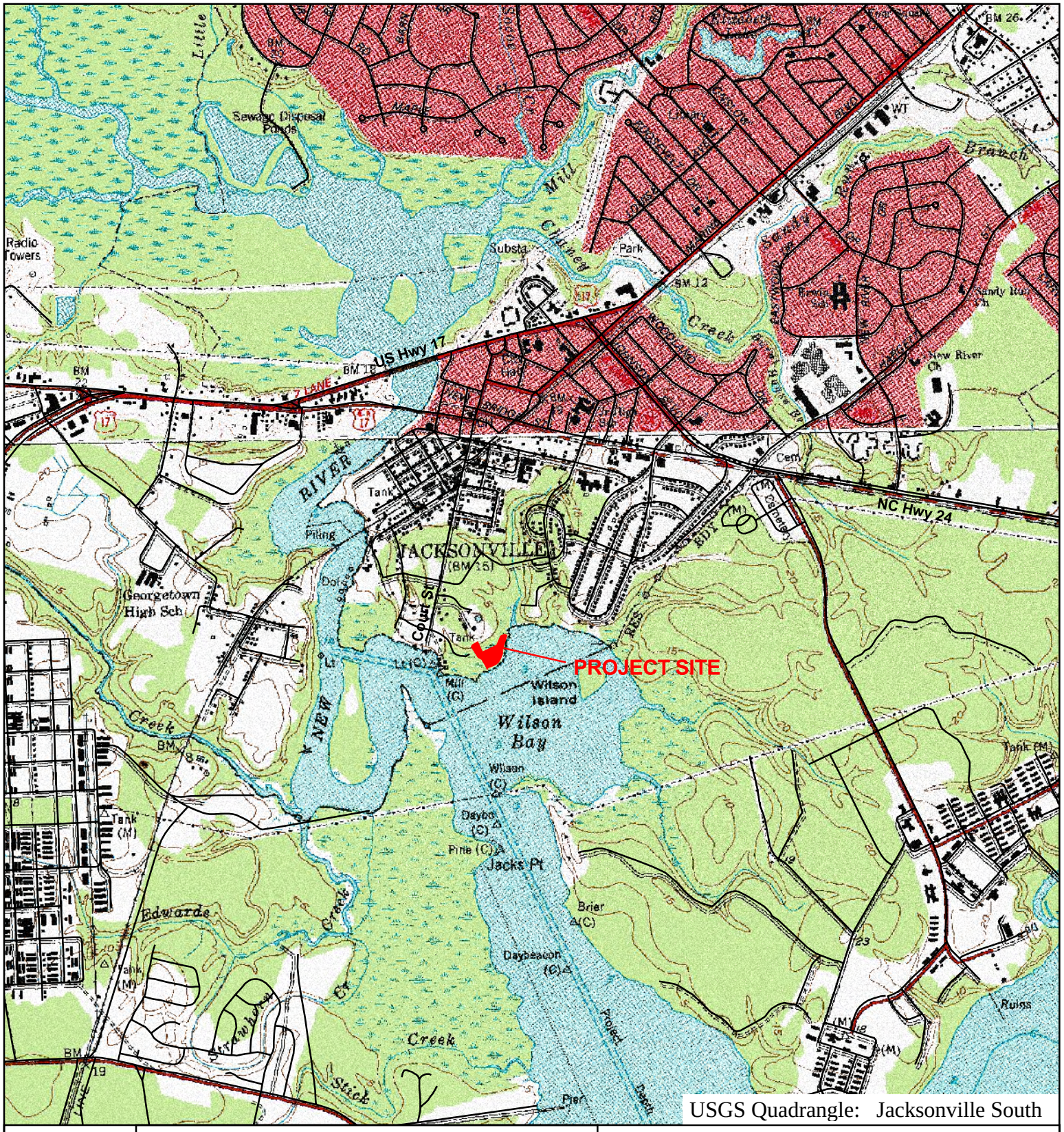

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Figure 1. Vicinity Map
Wilson Bay (Sturgeon City) Wetland Restoration Phase I

Jacksonville, Onslow County, NC
2005 Annual Monitoring - Year 4 of 5

EEP Project Number: .00090
BLWI Project Number: 050038

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2000 0 2000 Feet

Scale: 1" = 2000' November 2005

C. **Project History**

Design and construction oversight services for this project were provided by BLUE: Land, Water, Infrastructure, PA (BLWI). The construction was undertaken by Eastern Excavating Inc of Jacksonville. The planting was undertaken by Southern Landscaping of Jacksonville. Construction at the site began in early 2001. Planting of the site was completed later that Spring. Vegetation representative of several natural 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.

Exhibit Table III. Project Activity and Background
Project Number and Name: 050038 Sturgeon City Phase I

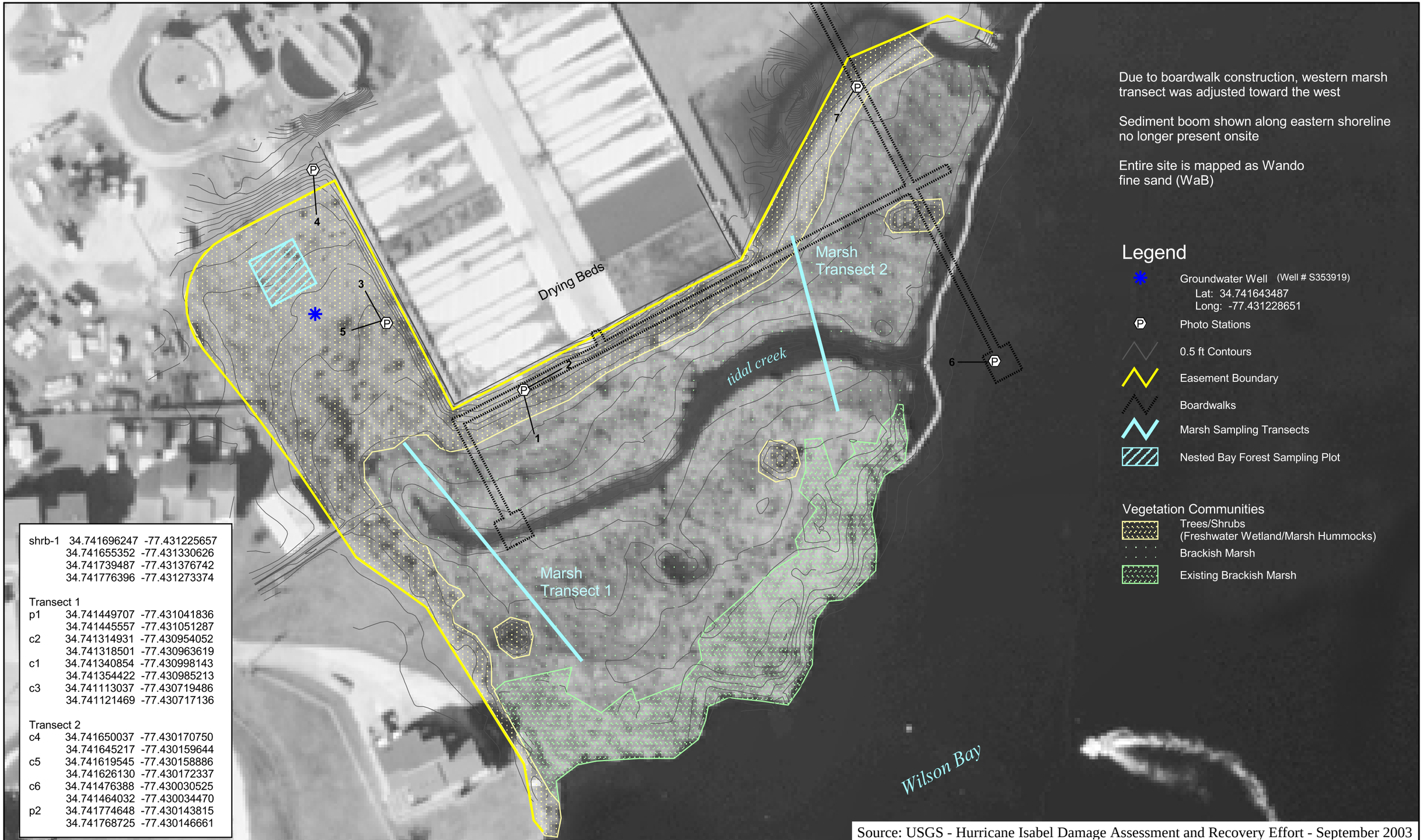
Activity or Report	Calendar Year of Completion or Planned Completion	Actual Completion Date
Restoration Plan (plan set)	2000	01/14/2001
Mitigation Plan	none	none
Construction	2001	03/2001
Temporary EIS mix applied to nonbrackish project area	2001	03/2001
As-Built Report (map only)	2001	09/30/2001
Permanent seed mix applied to wetland areas	none	none
Marsh plantings	2001	04/2001
Containerized and B&B plantings for wetland/buffer areas	2001	06/2001
Initial - Year 1 Monitoring (S&EC)	2001	11/26/2001
Year 2 Monitoring	2002	none
Year 3 Monitoring (NCSU Water Quality Group)	2003	10/01/2003
Year 4 Monitoring (NCSU Water Quality Group)	2004	05/2004, 10/2004
Year 5 Monitoring (BLWI)	2005	9/22/2005

Exhibit Table IV. Project Contact Table Project Number and Name: 050038 Sturgeon City Phase I	
Project Designer	**BLUE: Land, Water, Infrastructure, PA** 1271 Old US Highway 1 S., Southern Pines, NC 28387
Project designer POC	Thomas S. Blue PE PLS (910) 692-6461
Property Owner	**City of Jacksonville** PO Box 128, Jacksonville, NC 28541
Property owner POC	Glenn Hargett (910) 938-5200
Construction Contractor	**Eastern Excavating** 143 Penquin Lane, Jacksonville, NC 28546
Construction contractor POC	Terry Williams (910) 353-9100
Planting Contractor	**Southern Landscaping & Grounds Management** 1379 Burgaw Highway, Jacksonville, NC 28540
Planting contractor POC	George Smith (910) 346-6092
Seeding Contractor	none
Temporary Seed Mix Sources	none
Nursery Stock Suppliers	Campbell's Greenhouse, Raleigh, NC (marsh plants)
Monitoring Performers	**BLUE: Land, Water, Infrastructure, PA** 1271 Old US Highway #1 S., Southern Pines, NC 28387
Monitoring POC	Larry Hobbs (919) 306-2410 Thomas Blue (910) 692-6461

Exhibit Table V. Project Background Table Project Number and Name: 050038 Sturgeon City Phase I	
Project county	Onslow
Drainage area	n/a
Drainage impervious cover estimate (%)	n/a
Stream order	1 (tidal creek), n/a (New River)
Physiographic region	Coastal Plain
Ecoregion	63h Carolina Flatwoods
Rosgen classification of as-built	n/a
Cowardin classification	Intertidal Persistant Emergent Wetland, Irregularly Flooded
Dominant soil types	Wando Fine Sand
Reference site ID	n/a
USGS HUC (project and reference)	03030001
NCDWQ subbasin (project and reference)	03-05-02
NCDWQ classification (project and reference)	SC HQW/NSW
Any portion of the project area 303d listed?	Yes
Any upstream portion 303d listed?	Yes
Reasons for 303d listing or stressor	Nutrients, Fecal Coliforms, Chlorophyll a
% of project easement fenced	All landward, none waterward

D. **Monitoring Plan View (see Figure 2)**

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 transact.. One 10 meter by 10 meter sampling plot was located in the Bay Forest. 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. Vegetation height, stem counts, and percent cover was measured and recorded along the transects and in the plot.



shrb-1	34.741696247	-77.431225657
	34.741655352	-77.431330626
	34.741739487	-77.431376742
	34.741776396	-77.431273374
Transect 1		
p1	34.741449707	-77.431041836
	34.741445557	-77.431051287
c2	34.741314931	-77.430954052
	34.741318501	-77.430963619
c1	34.741340854	-77.430998143
	34.741354422	-77.430985213
c3	34.741113037	-77.430719486
	34.741121469	-77.430717136
Transect 2		
c4	34.741650037	-77.430170750
	34.741645217	-77.430159644
c5	34.741619545	-77.430158886
	34.741626130	-77.430172337
c6	34.741476388	-77.430030525
	34.741464032	-77.430034470
p2	34.741774648	-77.430143815
	34.741768725	-77.430146661

Source: USGS - Hurricane Isabel Damage Assessment and Recovery Effort - September 2003

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Figure 2. Monitoring Plan View
Wilson Bay (Sturgeon City) Wetland Restoration Phase I
Jacksonville, Onslow County, NC
2005 Annual Monitoring - Year 4 of 5

60 0 60 120 180 Feet

Scale: 1" = 60'
November 2005

EEP Project Number: .00090
BLWI Project Number: 050038

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III. Project Condition and Monitoring Results

A. Vegetation Assessment

1. Soil Data

Exhibit Table VI. Preliminary Soil Data
Project Number and Name: 050038 Sturgeon City Phase I

Series	Max Depth (in)85	Clay on Surface (%)	K	T	Organic Matter (%)
Wando (WaB)	85	1	0.1	5	<1

2. Vegetative Problem Areas

Exhibit Table VII. Vegetative Problem Areas
Project Number and Name: 050038 Sturgeon City Phase I

Feature/Issue	Area	Probable Cause	Photo #
Salt shrub, Spartina patens. vegetation removal	1,920 sf	Construction of Boardwalk along drying beds	VPA-1,

Vegetative Problem Area Photos (see Appendix A)

3. Problem Area Plan View (see Figure 3)

The plan view indicates the location of noted problems.

Problem area depicted was impacted by boardwalk construction, shrubs were removed

Due to boardwalk construction, western marsh transect was adjusted toward the west

Sediment boom shown along eastern shoreline no longer present onsite

Entire site is mapped as Wando fine sand (WaB)

Legend

- Groundwater Well
  Lat: 34.741643487
  Long: -77.431228651
- Photo Stations
- 0.5 ft Contours
- Easement Boundary
- Boardwalks
- Marsh Sampling Transects
- Nested Bay Forest Sampling Plot
- Problem Area - Shrub Removal

Vegetation Communities

- Trees/Shrubs (Freshwater Wetland/Marsh Hummocks)
- Brackish Marsh
- Existing Brackish Marsh

shrb-1	34.741696247	-77.431225657
	34.741655352	-77.431330626
	34.741739487	-77.431376742
	34.741776396	-77.431273374
Transect 1		
p1	34.741449707	-77.431041836
	34.741445557	-77.431051287
c2	34.741314931	-77.430954052
	34.741318501	-77.430963619
c1	34.741340854	-77.430998143
	34.741354422	-77.430985213
c3	34.741113037	-77.430719486
	34.741121469	-77.430717136
Transect 2		
c4	34.741650037	-77.430170750
	34.741645217	-77.430159644
c5	34.741619545	-77.430158886
	34.741626130	-77.430172337
c6	34.741476388	-77.430030525
	34.741464032	-77.430034470
p2	34.741774648	-77.430143815
	34.741768725	-77.430146661

Source: USGS - Hurricane Isabel Damage Assessment and Recovery Effort - September 2003

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Figure 3. Vegetative Problem Area Plan View
Wilson Bay (Sturgeon City) Wetland Restoration Phase I
Jacksonville, Onslow County, NC
2005 Annual Monitoring - Year 4 of 5

60 0 60 120 180 Feet

Scale: 1" = 60'
November 2005

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4. **Stem Counts**

Marsh vegetation was assessed in six *Spartina cynosuroides* 1m x 1m plots and in two *Spartina patens* 1m X 1m plots (Exhibit 8). Methodology from previous monitoring visits was followed and stems were not counted in the *S. patens* plots.

Transact 1 was shifted slightly to a new location for this monitoring report because of boardwalk construction which did not allow the transact to be observed in its original location. Overall, the transects showed good tidal water flow throughout the habitat and the *Spartina cynosuroides* marsh has a very good old growth organic mat substrate being formed. The marsh has matured enough to have very little problem with invasive species. The *Spartina patens* marsh was impacted by construction of the boardwalk, but has recovered well over the last year. Small patches of Goldenrod continue to be a minor problem.

Other smaller vegetative communities within the marsh were visited and seemed to be functioning well, but were too small to justify additional plots.

The Bay Forest Plot was growing well. The presence of some volunteer species was noted. In particular willow, broom sedge, dog fennel, and fescue were the major species recorded. At this time, the presence is not considered detrimental to the success and growth of the area.

Vegetative trends have shown that stem counts this year were generally lower than in previous years. This should not be of concern as the marsh is maturing and still maintains a high percentage of cover.

Table VIII. Stem Counts (Marsh Transects)
Project Number and Name: 050038 Sturgeon City Phase I

Transect 1 – East				
Species	Plot	Count	Height (m)	Cover (%)
Spartina cynosuroides	C1	24	1.25-2.70	60
	C2	41	1.0-2.42	70
	C3	26	2.14-2.09	60
Spartina patens	P1	not available	1.12-1.28	60
Transect 2 – West				
Species	Plot	Count	Height (m)	Cover (%)
Spartina cynosuroides	C4	26	2.0-3.30	75
	C5	29	1.98-3.40	80
	C6	37	1.21-3.44	65
Spartina patens	P2	not available	1.24-1.42	65

Table IX. Stem Counts (Bay Forest Plot) Project Number and Name: 050038 Sturgeon City Phase I					
Tree Stratum					
Species	Height (cm)	Diameter (mm)*	Density	Rank (Importance)	
Pinus serotina	418	125	6	1	
	226	66			
	212	62			
	84	11			
	63	8			
	53	11			
*Magnolia virginiana***	171	39	1	2	
Planted Trees per acre	160				
Trees per acre	280				
Natural reg trees per acre	120				
Shrub Stratum					
Species	Cover (%)	Rel. Cover (%)	Density	Rel. Density (%)	Rank (Importance)
Ilex coriacea	6	0.75	2	66.7	1
Morella cerifera	2	0.25	1	33.3	2
Total	8	100	3	100	
Herb Stratum					
Species	Cover (%)	Rel. Cover (%)	Rank (Importance)		
Solidago sp.	3	3	2		
Festuca sp.	>95	>95	1		
Ipomoea sp.	<1	<1	2		
Panicum sp.	<1	<1	2		
Wisteria sp.	<1	<1	2		
Total	100	100			

*Diameter = diameter at root collar

***Magnolia virginiana* was considered a shrub in previous monitoring reports, alters previous planted trees per acre

Table X. Vegetation Trends (Marsh Area) Project Number and Name: 050038 Sturgeon City Phase I				
		Lower marsh (S. cynosuroides) Data Range		
Monitoring Year	Firm	Stem Count	Height (m)	Cover %
2001	S&EC		unavailable	
2003+	NCSU	55-87	2-2.5	35-60
2004*	NCSU	52-66	1.75-2.5	45-60
2005+	BLWI	24-41	1.0-3.4	60-80
		Upper marsh (S. patens) Data Range		
Monitoring Year	Firm	Stem Count	Height (m)	Cover %
2001	S&EC		unavailable	
2003	NCSU	n/a	0.75-1	100
2004	NCSU	n/a	0.75-1	100
2005	BLWI	n/a	1.1-1.4	60-65

*based on 4 plots

+based on 6 plots

4. Vegetation Plot Photos (see Appendix A)

B. **Wetland Assessment and Recommendations**

In general, the established brackish marsh appears to be growing well. Stems counts have dropped in the year 2005, which could be a sign of the marsh maturing, since height and % cover increased. For the upcoming closeout year, samples (3) should be taken in the nearby natural stands for a comparison.

1. Wetland Problem Areas

An area of Spartina patens was disturbed during boardwalk construction along the drying beds, but the site appears to be reestablishing well.

Table XI. Wetland Problem Areas Project Number and Name: 050038 Sturgeon City Phase I			
Feature/Issue	Area	Probable Cause	Photo #
Spartina patens vegetation removal	1,280 sf	Construction of boardwalk along drying beds	WPA-1

Wetland Problem Area Photos (see Appendix A)

2. Wetland Problem Areas Plan View (see Figure 4)

The plan view indicates the location of noted problems.

3. Wetland Criteria Attainment

There is only one ground water well, RDS WL-40, located within the project area. It is the upper portion of the bay forest. The site (visual observation) indicates the marsh area seems to exhibit appropriate hydrology (tidal) to support the targeted marsh habitat (see Figure 5). From the beginning of January 2005 through the end of November 2005 ground water levels which support wetland status were maintained. During this year higher than normal rainfall during the months of September and October were the result of hurricane Ophelia and a tropical storm.

For the upcoming closeout year, the water level/tide data collected by the City of Jacksonville staff should be verified and used to support hydrologic conditions. This data would show monthly trends in water level fluctuations in the creek, marsh and fringed wetlands; areas were data is unavailable.

Groundwater well data meets hydrology threshold.

Sediment boom shown along eastern shoreline no longer present onsite

Entire site is mapped as Wando fine sand (WaB)

Drying Beds

Marsh Transect 2

Marsh Transect 1

tidal creek

Wilson Bay

1 2 3 4 5 6 7

Legend

- Groundwater Well
  Lat: 34.741643487
  Long: -77.431228651
- Photo Stations
- 0.5 ft Contours
- Easement Boundary
- Boardwalks
- Marsh Sampling Transects
- Nested Bay Forest Sampling Plot
- Problem Area - Spartina patens Removal

Vegetation Communities

- Trees/Shrubs (Freshwater Wetland/Marsh Hummocks)
- Brackish Marsh
- Existing Brackish Marsh

Source: USGS - Hurricane Isabel Damage Assessment and Recovery Effort - September 2003

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Figure 4. Wetland Problem Area Plan View
Wilson Bay (Sturgeon City) Wetland Restoration Phase I
Jacksonville, Onslow County, NC
2005 Annual Monitoring - Year 4 of 5

60 0 60 120 180 Feet

Scale: 1" = 60'
November 2005

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IV. **Methodology Section**

Methodology from previous monitoring visits was followed to enable data comparison between monitoring years. Exact replication of monitoring plots was not possible due to installation of the boardwalk and the previous removal of most of the PVC plot boundary markers.

V. **References**

NCSU Water Quality Group. "Wilson Bay Wetland Restoration Phase I, 2003 Annual Monitoring Report."
North Carolina State University, Biological and Agricultural Engineering, WRRI, March 2004.

NCSU Water Quality Group. "Wilson Bay Wetland Restoration Phase I, 2004 Annual Monitoring Report."
North Carolina State University, Biological and Agricultural Engineering, WRRI, December 2004.

BLUE: Land, Water, Infrastructure. Wilson Bay / Sturgeon City Wetland Restoration Phase I, in-house planning and design files.

Appendix A
Photos

Vegetative Plot Photos - Transect 1

P1

C1

C2

C3

Vegetative Plot Photos - Transect 2

P2

C4

C5

C6

Vegetative Problem Area Photos

VPA-1 Salt shrub removal along drying beds for boardwalk construction 1

Wetland Problem Area Photos

WPA-1 Spartina patens trying to reestablish after boardwalk construction

Site photos (associated with established photo points)

W-1

W-2

W-3

W-4

W-5

W-6

W-7

Appendix B
Wetland Graph

Sturgeon City Phase I
S353919
(Figure 5)