

# MONITORING PLAN

## *Wilson Bay Wetland Restoration - Phase I*

Jacksonville, Onslow County, North Carolina

*Prepared by*

**BLUE** Land  
Water  
Infrastructure, PA

*Submitted to*



The North Carolina Wetlands Restoration Program  
1619 Mail Service Center  
Raleigh, North Carolina 27699-1619

August 6, 2001  
BLWI Project Number 990752

MONITORING PLAN - WILSON BAY WETLAND RESTORATION - PHASE I  
Jacksonville, Onslow County, North Carolina

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## INTRODUCTION

The North Carolina Wetlands Restoration Program (NCWRP) was established to restore wetlands, streams and stream side areas throughout the state. The NCWRP has designated potential restoration areas that will most effectively improve the water quality, flood prevention, and fisheries and wildlife habitat functions. Wilson Bay is one of these priority areas and the NCWRP intends to restore some of the wetlands lost through the development of the former Jacksonville wastewater treatment plant. This project is part of that plan to restore wetland near Wilson Bay. The City of Jacksonville also plans to create a sturgeon hatchery (“Sturgeon City”) using the tanks and other facilities of the former wastewater treatment plant. The restored wetlands will provide conditions conducive to the ongoing efforts to reestablish shellfish in the Bay.

The NCWRP acquired a conservation easement from the City of Jacksonville for the purposes of this wetland restoration. The easement consists of 3.06 acres of waterfront property at the former Jacksonville Wastewater Treatment Plant site on Wilson Bay. After analyzing historical photographs going back to 1938, before the treatment plant was built, it is apparent the easement area was a tidal wetland. The treatment plant proceeded in later years to fill and dump soil and debris into the wetland. A small fringe of tidal wetland still exists on the waterfront. The existing marsh will remain undisturbed. The restoration plans are to excavate the manmade fill piles and convert the easement area back to its historical state of tidal wetland. This area will be preserved in a permanent conservation easement.

## VEGETATION

Construction and grading work will be completed in the spring of 2001. Once the excavation and grading work is complete, revegetation will take place. Grasses will be planted first, followed by shrubs and trees. (See “Project Specifications - Wilson Bay Wetland Restoration Phase I” for more details on plant material and installation). Successful vegetation establishment is an essential factor in restoring appropriate wetland functions and sustainability of the site.

### Methods

Vegetation monitoring will be led by a trained biologist. Approximately 1% of the total area of each vegetation community type will be assessed annually to determine overall vegetation status. Vegetation species, percentage survival and percent cover, as well as overall condition when compared to the planting plan will be assessed using predetermined plots (Table 1, Appendix A, Appendix B). Quick visual assessments of the remaining area will also be conducted to insure that no severely impaired vegetation, bare spots, or large communities of invasive plants exist.

**Table 1. Sampling Plots**

<i>Community Type</i>	<i>Area (acres)</i>	<i>No. of Plots</i>	<i>Plot Size</i>
Bay Forest Area	0.28	2	5' x 10'
Cypress-Gum Swamp Area	0.07	2	3' x 5'
Salt-Shrub Area	0.49	2	10' x 10'
Brackish Marsh	1.87	8	10' x 10'

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**Success Criteria**

Successful revegetation will be realized when 75% vegetative coverage is attained throughout the site and the plants have survived for five years. Plant survival and coverage is determined by the percent of material alive based on the planting spacing. Coverage of 25% should be achieved after the first year, 50% coverage should be reached after the third year, and 75% after the 5th year. If the vegetation establishment does not meet these goals by the specified time the *“Wilson Bay Wetland Restoration Phase I - Management Plan”* should be consulted to determine the appropriate measures to fix the problem.

**Monitoring Timeline**

Vegetation will be monitored annually for five years beginning in September 2001. A report outlining findings will be submitted to the North Carolina Wetlands Restoration Program no later than two months after each monitoring field visit.

**HYDROLOGY**

Two types of hydrology exist on-site, groundwater and tidal. The marsh plants require tidal influences to survive thus tidal hydrology will be deemed successful if the plants are successful. Groundwater hydrology functions are essential to the “Bay Forest”, “Cypress-Gum Swamp”, and the “Salt Shrub” areas (Appendix B).

**Methods**

Two groundwater monitoring wells will be installed on-site after construction has been completed. One well will be located in the higher elevation “Bay Forest” area of the site while the other will be located in the lower elevation “Salt Shrub.” Water level readings will be taken daily, stored using a data logger, and data will be retrieved every year during the monitoring visit.

Soil temperature will be monitored to determine the length of the growing season. According to the US Army Corps of Engineers (USACE) Wetlands Delineation Manual (1987), the growing season is defined as the portion of the year when soil temperature at 19.7 inches below the surface is higher than biological zero (5°C). One thermocouple will be installed on-site. Temperature readings will be taken at various times throughout the day and stored using a data logger. Data will be retrieved during the annual monitoring visit. Water level and soil temperature data will be collected for 5 years beginning in summer 2001.

**Success Criteria**

Hydrologic conditions will be deemed successful if the water table is within 12 inches of the surface for at least 5% of the growing season for at least 50% of the years in the monitoring period (USACE 1987). The number of days that make up the 5% must be consecutive. These conditions will support the introduced wetland vegetation communities and promote microbial activity. The growing season will be determined by use of soil temperature, as described above. If problems concerning hydrology are observed, refer to the *“Wilson Bay Wetland Restoration Phase I - Management Plan”* to determine the appropriate course of action.

## **CONCLUSION**

A monitoring report will be produced following each annual monitoring site visit. Each report will include a list of any vegetation or hydrology problems which may threaten the ability to obtain success criteria. If needed, photographs and a map indicating the locations of problem areas will be included in the report. Revegetation, soil amendments, erosion control, vandalism, and many more management issues are covered in the "*Wilson Bay Wetland Restoration Phase I - Management Plan.*" The monitoring report will refer to the appropriate section in the management plan whenever corrective actions are deemed necessary to reach success criteria goals. Each report will detail methods for collecting data, any problems in collecting data, the results of the data, and how those results compare to success criteria.

## APPENDIX A

### Planted Wetland Species

Appendix A. Wetland plant species that will be installed at the restoration site.

COMMUNITY	SCIENTIFIC NAME	COMMON NAME	PLANTING
Bay Forest	<i>Cyrilla racemiflora</i>	Titi	scattered
	<i>Dionaea muscipula</i>	Venus Fly Trap	clustered
	<i>Gordonia lasianthus</i>	Loblolly Bay	scattered
	<i>Ilex coriacea</i>	Sweet Gallberry	scattered
	<i>Ilex glabra</i>	Bitter Gallberry	scattered
	<i>Ilex cassine</i>	Dahoon	scattered
	<i>Kalmia angustifolia</i>	Lamb-Kill	scattered
	<i>Lyonia lucida</i>	Fetterbush	clustered
	<i>Magnolia virginiana</i>	Sweet Bay	scattered
	<i>Myrica heterophylla</i>	Bayberry	scattered
	<i>Persea palustris</i>	Swamp Bay	scattered
	<i>Pinus palustris</i>	Longleaf Pine	scattered
	<i>Pinus serotina</i>	Pond Pine	scattered
	<i>Rhododendron viscosum</i>	Swamp Azalea	scattered
	<i>Sarracenia flava</i>	Yellow Pitcher Plant	clustered
<i>Sarracenia purpurea</i>	Purple Pitcher Plant	clustered	
Salt Shrub	<i>Baccharis halimifolia</i>	Sea Myrtle	throughout
	<i>Hibiscus moscheutos</i>	Rose Mallow	throughout
	<i>Iva frutescens</i>	Marsh Elder	massed
	<i>Juniperus virginiana</i>	Eastern Red Cedar	throughout
	<i>Kosteletskya virginica</i>	Seashore Mallow	throughout
	<i>Myrica cerifera</i>	Wax Myrtle	massed
Brackish Marsh	<i>Cladium jamaicense</i>	Saw Grass	grouped
	<i>Juncus roemerianus</i>	Black Needlerush	scattered
	<i>Spartina cynosuroides</i>	Giant Cordgrass	grouped
	<i>Spartina patens</i>	Saltmeadow Cordgrass	grouped
Marsh Hummock	<i>Baccharis halimifolia</i>	Sea Myrtle	massed
	<i>Juniperus virginiana</i>	Eastern Red Cedar	throughout
	<i>Myrica cerifera</i>	Wax Myrtle	throughout
Tidal Creek	<i>Scirpus robustus</i>	Saltmarsh Bulrush	grouped
Gum-Cypress Swamp	<i>Cyrilla racemiflora</i>	Titi	scattered
	<i>Leucothoe axillaris</i>	Coastal Dog-Hobble	scattered
	<i>Lyonia lucida</i>	Fetterbush	massed
	<i>Nyssa biflora</i>	Swamp Tupelo	scattered
	<i>Nyssa aquatica</i>	Water Tupelo	scattered
	<i>Persea borbonia</i>	Red Bay	scattered
	<i>Saururus cernuus</i>	Lizard Tail	scattered
	<i>Taxodium distichum</i>	Bald Cypress	throughout

## APPENDIX B

### Planting Plan Map



**RESPONSE TO APPENDIX A:**

**NORTH CAROLINA WETLANDS RESTORATION  
PROGRAM MITIGATION  
PLANS AND SPECIFICATIONS CHECKLIST FOR SECTION 404  
PERMIT MITIGATION SITES  
(April 2, 1998 version)**

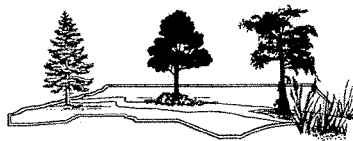
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**N.C. Wetlands Restoration Program**  
NCDENR DWQ

The North Carolina Wetlands Restoration Program  
1619 Mail Service Center  
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RESPONSE TO APPENDIX A:  
NORTH CAROLINA WETLANDS RESTORATION PROGRAM MITIGATION  
PLANS AND SPECIFICATIONS CHECKLIST FOR SECTION 404 PERMIT  
MITIGATION SITES (April 2, 1998 version)

**Appendices included:**

**Appendix A: Location Map**

**Appendix B: Set of engineering plans and drawings entitled “Wilson Bay Wetland Restoration Phase I” dated 01/14/2001 (Sheets 1 through 8)**

**Appendix C: Reference Marsh Location Map**

**Appendix D: Photographs**

**Appendix E: “Project Specifications - Wilson Bay Wetland Restoration Phase I”**

**Appendix F: “Wilson Bay Wetland Restoration Phase I - Management Plan”**

**Appendix G: Soil Report**

**Appendix H: Tide gage data**

**Appendix I: “Wilson Bay Wetland Restoration Phase I - Monitoring Plan”**

**Appendix J: “Map of a Topographic Survey of the North Carolina Wetlands Restoration Program Wilson Bay (Sturgeon City) Wetland Restoration Project (Phase I)”**

Standard font indicates original “Appendix A” outline, while responses are designated in bold font.

- I. Location Information.
  - A. Watershed by USGS Hydrologic Map Cataloging Unit Number. **White Oak River Basin (WOK2 #03-05-02) (code: 03030001010050).**
  - B. County. **Onslow.**
  - C. Stream name and classification. **Wilson Bay fed by New River (SC HQW NSW).**
  - D. Site identified on USGS Quad sheet or NWI map (7.5 minute) (with quad sheet name) and UTM coordinates of site. **Jacksonville South Quad Sheet, 3846750 meters N, 277500 meters E.**
  - E. Site identified on NRCS Soil Survey with appropriate Sheet Numbers. **Onslow County Soil Survey, Sheet 29.**
  - F. Narrative description of location, including roads, nearest municipality, and general description of how to get to the site. **Jacksonville, near downtown. US 258 over old bridge, south on Court Street, old treatment plant on the left.**
  - G. Location map with roads and nearest municipality (not larger than 1” = 400’). **Appendix A. Location Map.**

II. Project Description (should be stated in terms of goals and objectives).

The City of Jacksonville has plans to create a museum, education complex, and research facility including a sturgeon hatchery (“Sturgeon City”) using the tanks and other facilities of a former wastewater treatment plant. The goal of this part of the project is to support ongoing efforts to improve water quality and aquatic habitat by restoring a portion of the site that has been impacted by the wastewater treatment plant back to historic brackish marsh. The restored wetland will help stabilize the shoreline, filter runoff, and provide wildlife and aquatic habitat. After the wetland is established, the City of Jacksonville plans to create access to the wetland for public enjoyment and education by building a boardwalk. Another objective of this marsh restoration project is to buffer the bay from the additional traffic anticipated from the revitalization efforts of the wastewater treatment plant.

A. Type of mitigation (restoration, creation, enhancement, preservation).  
**Restoration and preservation.**

1. Cowardin classification and/or stream type (cold water, cool water, or warm water). **E2EM1/SS1P = estuarine intertidal, emergent, persistent/scrub-shrub broad-leaved deciduous irregularly flooded.**
2. Narrative description of vegetation types to be established or existing. **A fringe of marsh grass exists along the southern shore of the property. This brackish marsh vegetation will be extended further inland and along the northern shore. Landward, a salt shrub area consisting of shrubs and herbaceous plants will border the marsh grasses. Along the western property boundary a cypress-gum swamp community with shrubs and trees will be created. A bay forest will be created in the northwest portion of the property. This forest will contain trees, shrubs, and herbaceous plants. (Community types based upon native communities and *Classification of the Natural Communities of North Carolina, Third Approximation*, NCNHP, NCDEHNR, 1990).  
**Appendix B. Sheet 6 - Plantings.****
3. Use of a reference ecosystem in site planning and design and detailed description of that system.  
**Photography, USGS maps and on-site investigations were utilized to find areas which could be studied to create a basis for the restoration plan. Three areas were found and were investigated to determine marsh characteristics. Reference Marsh #3, to the west of the property, was investigated briefly with only a visual inspection. The other two reference areas, #1 and #2, are located on the city of Jacksonville property and were investigated in detail. During the investigation, plant species lists were made, vegetation breaks were staked and surveyed, and soils were sampled. The reference marshes contain *Spartina cynosuroides* with small amounts of *Scirpus robustus***

and *Spartina patens*. The salt shrub zone contains *Myrica cerifera*, *Baccharis halimifolia*, *Juniperus virginiana*, *Iva frutescens* and *Borrchia frutescens*. In general, the marsh is dominated by *Spartina cynosuroides* with small salt shrub hummocks throughout. The marsh limits are 0.8 ft to 2.5 ft (NGVD 29). The restored marsh is modeled after the information obtained from the reference wetlands. Appendix C. Reference Marsh Location Map, Appendix D. Photograph 1.

B. Project Size.

1. Overall site size. **3.06 acres.**
2. Acreage of each type of mitigation intended on the site.  
**Preservation = 0.25 acres; Restoration = 2.81 acres.**
3. Acreage of each vegetation type (by Cowardin classification) intended on site. **EM1: emergent persistent - 1.87 acres, SS1: scrub-shrub broad-leaved deciduous - 0.49 acres, FO1: forested broad-leaved deciduous - 0.35 acres.**

**By Classification of the Natural Communities of North Carolina, Third Approximation (NCNHP, NCDEHNR, 1990): bay forest area (FO1) - 0.28 acres, cypress-gum swamp area (FO1) - 0.07 acres, salt shrub area (SS1) - 0.49, brackish marsh (EM1) - 1.87 acres. Appendix B. Sheet 2 - Schematic Layout.**

4. Location map showing each mitigation type and vegetation type.  
**Appendix B. Sheet 2 - Schematic Layout and Sheet 6 - Plantings**

C. Wetland and/or stream functions goals and objectives for establishment (if restoration or enhancement) or existing (if preservation).

1. Description of how functions are determined or evaluated, methodologies used, etc. If modeling is used, assumptions, highs, lows, and averages should be included. **Reference marshes and an on-site tide gage were used to determine functions and community types.**
2. Endangered species present or likely in the future or being impacted either positively or negatively. **No endangered species are recognized by the NC Natural Heritage Program to be in the vicinity and none are likely to be impacted negatively, however this project is part of a plan to improve water quality and reintroduce the endangered sturgeon to Wilson Bay.**

3. Description of existing (pre-mitigation project) functions and how the goals of the mitigation will contribute to desired functions and/or values. **Areas of artificially created upland exist throughout the property due to past dumping and construction-related activities from the old wastewater treatment plant. The upland areas have limited the property's hydrologic connection to tidal influences causing freshwater wetlands to form landward. A small tidal brackish marsh, which will be preserved, exists along the shore. The disturbed mitigation areas will be graded and returned to their historical function as a brackish marsh. Marsh hummocks and a tidal creek will be installed to create and enhance wildlife habitat. The increase in habitat and total wetland area will add up to create an increase in water quality for Wilson Bay.**

D. Vegetation.

1. Pre-mitigation project description of vegetation of site with appropriate maps. **Historical land development activities such as filling and dumping associated with the construction and operation of the treatment plant have altered the land surface of the area. By limiting contact of areas with the waters from Wilson Bay, plant communities other than brackish marsh, such as non-tidal freshwater wetlands and uplands, have developed. The artificially created non-tidal freshwater wetlands are remnants of waste lagoons used by the old wastewater treatment plant. The upland is mostly comprised of a maintained grass lawn. A few small areas of red cedar and willow exist throughout the site. Appendix B. Sheet 3 - Existing Topography and Demolition and Appendix D. Photographs 2-3.**
2. Mitigation site vegetation goals and objectives. **The goal of the project is to restore the disturbed mitigation area to brackish marsh vegetation. Three small marsh hummocks, as seen in the reference marsh, with shrubs and trees will be created within the brackish marsh area. Landward, a salt shrub area, a cypress-gum swamp community, and a bay forest will be created. These areas will contain trees, shrubs, and herbaceous plants selected for their respective community types based upon *Classification of the Natural Communities of North Carolina, Third Approximation* (NCNHP, NCDEHNR, 1990) and the analysis of the reference marsh area. These vegetation communities are designed to provide habitat, promote survival, increase water quality, and provide educational opportunities. Appendix B. Sheet 6 - Plantings.**

E. Wetland Hydrology.

1. Pre-mitigation project description of hydrology of site with appropriate maps. **Areas of artificially created upland exist throughout the property due to past dumping and construction-related activities from the old wastewater treatment plant. The upland areas have limited the property's hydrologic connection to tidal influences causing freshwater wetlands to form landward. A tidal brackish marsh exists along the shore. Currently, stormwater enters the property through a ditch on the western boundary and surface runoff from the north. Appendix B. Sheet 3 - Existing Topography and Demolition.**
2. Mitigation site hydrology goals and objectives with appropriate maps. **The site will be graded in such a manner as to remove the upland barriers and facilitate a tidal influence across a larger extent of the property. Appendix B. Sheet 4 - Grading/Erosion and Sediment Control.**

F. Soils.

1. Pre-mitigation project description of soils of site with appropriate maps. **Soils on site range from loamy sand to sand. In the wetland areas the soil is saturated to the surface. In soil borings, particles of wetland vegetation were found six feet under the surface in upland areas. This combined with dark soil color (10YR 2/1) indicates the historical surface has been buried under filling or other land disturbances. Fragments of glass, plastic, metal, and other debris were found while augering to a depth of six feet. Some larger fragments of asphalt, marl, concrete and rocks were also encountered.**
2. Mitigation site soils goals and objectives with appropriate maps (if changes in the soils are being made). **Unconsolidated fill material will be removed to 6" below final grade and clean topsoil will be added for planting. Soil objectives include stability and the ability to support the growth of the proposed plants. Debris removal will facilitate another objective of presenting an aesthetically pleasing, safe, and accessible environment for educational and viewing purposes.**

III. Site Preparation Plan.

- A. Orientation and scale maps (1" = 50'). **Refer to Appendix B. "Wilson Bay Wetland Restoration Phase I" site plans (Sheets 1-8) and Appendix E. "Project Specifications - Wilson Bay Wetland Restoration Phase I" (Specifications).**

- B. Schematic drawing of proposed changes in topography (3” contours for finished grades). Grading plan. **Appendix B. Sheet 4 - Grading/Erosion and Sediment Control.**
- C. Location and elevation of all structures, especially those controlling hydrology. **Appendix B. Sheet 4 - Grading/Erosion and Sediment Control.**
- D. Construction details for all structures. **Appendix B. Sheet 7 - Erosion Control Details, Specifications.**
- E. Spot elevations for low points, high points, and structures. All target elevations and grades mapped. **Appendix B. Sheet 4 - Grading/Erosion and Sediment Control.**
- F. Construction timetable.
  - 2/20/01        Begin construction - clearing, grubbing, demolition, erosion and sediment control**
  - 2/27/01        Continue construction - begin grading**
  - 3/02/01        Continue construction - begin temporary seeding**
  - 3/23/01        Finish construction**
- G. Benchmark locations. **Appendix B. Sheet 3 - Existing Topography and Demolition.**
- H. Limits of disturbance. **Appendix B. Sheet 4 - Grading/Erosion and Sediment Control.**
- I. Areas to be graded and backfilled (or filled). Description of earthwork moving required including amounts, type of soils moved and locations for borrow or relocation, sources of topsoils and the nature of these, grading, etc. **Appendix B. Sheet 4 - Grading/Erosion and Sediment Control, Appendix E. Specifications.**
- J. Property boundaries. **Appendix B. Sheet 3 - Existing Topography and Demolition.**
- K. Specifications for deconsolidation of substrates. **Appendix E. Specifications - Section “Earthwork.”**
- L. Stream/channel dimensions and configurations. **See tidal creek on Appendix B. Sheet 4 - Grading/Erosion and Sediment Control, Sheet 5 - Profile/Cross-Sections, Sheet 7 - Erosion Control Details.**
- M. Locations, sizes, nature, of existing or proposed buffers and map. **N/A**

- N. On-site wetland boundaries, existing and after mitigation (proposed). **Appendix B. Existing = Sheet 3 - Existing Topography and Demolition; After mitigation = Sheet 2 - Schematic Layout.**
  - O. Areas for stockpiling soils. **Appendix E. Specifications.**
  - P. Slope stabilization techniques. **Erosion control matting used on slopes; immediate seeding. Appendix B. Sheet 4 - Grading/Erosion and Sediment Control, Sheet 7 - Erosion Control Details, Appendix E. Specifications.**
  - Q. Maintenance procedures for maintaining slopes, grades, etc. **Immediate planting following grading completion with temporary seeding on any areas where planting is delayed. Maintenance of erosion control measures as described in specifications. Appendix B. Sheet 4 - Grading/Erosion and Sediment Control, Sheet 7 - Erosion Control Details, Appendix E. Specifications.**
  - R. Other important site features and/or considerations. **Appendix B. Sheets 1-8, Appendix E. Specifications.**
  - S. Habitat structures and locations. **Marsh hummocks are being planted as seen in reference marsh as wildlife habitat. Appendix B. Sheet 2 - Schematic Layout, Sheet 6 - Plantings, Sheet 8 - Planting Details.**
- IV. Vegetation Plans.
- A. Existing vegetation (description, species composition, relative abundance of dominants and subdominants, forest age, vegetation structure of uplands and wetlands). **The site is a highly disturbed urban area, with a grassed lawn and minimal wooded areas (red cedar and willow).**
  - B. Vegetation structure to be restored, enhanced, and/or created (description, species composition, relative abundance of dominants and subdominants, and vegetation structure of uplands and wetlands) (including buffers). **Appendix B. Sheet 6 - Plantings, and Sheet 8 - Planting Details.**
  - C. Plantings/seedings should be listed to species. Propagules should be listed as to whether “local” (within 200 miles north and south), and should be verified by a nursery certificate. Acceptable substitute species. Field collection instructions and techniques, if field collection is being used for sources. Plant material guarantees. **Appendix B. Sheet 8 - Planting Details, Appendix E. Specifications.**
  - D. If a Reference Ecosystem (RE) is used, the diversity and densities of species within the RE relative to the target for the mitigation site should be discussed. **The reference marshes, though slightly impacted, are dominated by *Spartina cynosuroides* with small zones of *Scirpus robustus* and *Spartina patens*. Based upon the experience of the staff, a larger percentage of *Scirpus robustus* and**



***Spartina patens* will be planted to increase diversity. The salt shrub community in the reference marsh is dominated by *Juniperus virginiana*, *Myrica cerifera*, and *Baccharis halimifolia*, with small amounts of *Iva frutescens* and *Borrchia frutescens*. Due to sight lines, percentages of *Juniperus virginiana* will be reduced and be kept to the side of the marsh. The reference marsh was not utilized in the preparation of the cypress-gum swamp area and the bay forest area. These areas are being proposed as transitional zones and for educational viewing purposes.**

- E. Transition zones between wetland and upland should be discussed with regards to suitable transition zone species and planting densities, and composition. **Within the bay forest area, a transition will occur from wetter species near the salt shrub area to drier species upslope. Appendix B. Sheet 6 - Plantings, Sheet 8 - Planting Details.**
- F. Sources of all plant materials, soils, fertilizers, habitat structures, etc. **Plant materials and fertilizers will be obtained from certified nurseries, while cleaned topsoil will be obtained from a local source.**
- G. Landscaping contractor's responsibilities (fertilization, irrigation or watering requirements, replacing plant mortalities, replanting seeded areas with transplants, temporarily protecting vegetation from wildlife, number of site inspections and frequencies). **Appendix E. Specifications.**
- H. Plant handling instructions, seeding instructions, and planting techniques. **Appendix B. Sheet 8 - Planting Details, Appendix E. Specifications.**
- I. Planting timetable.  
**3/16/01        Begin planting**  
**7/13/01        End planting**
- J. Schematic drawing of proposed vegetation distribution, spacing, and structure. **Appendix B. Sheet 6 - Plantings, Sheet 8 - Planting Details.**
- K. Areas to be vegetated identified on topo plans by species and planting methods. **Appendix B. Sheet 6 - Plantings, Sheet 8 - Planting Details.**
- L. Criteria for acceptable plant material. **Appendix E. Specifications.**
- M. Special plant conditioning requirements (brackish/salt marsh species). **Appendix E. Specifications.**
- N. Details of proposals for slope stabilization by vegetation. **Appendix E. Specifications.**

- O. Exotic and/or nuisance plant control methods. **Appendix F. Wilson Bay Wetland Restoration Phase I - Management Plan.**
- P. Vegetative buffer descriptions. N/A
- V. Soils plans.
  - A. Soils description and mapping (taxonomy, texture, color, structure, permeability, organic content, sampling map, etc.). **Soils on-site are comprised of unconsolidated fill material with bricks, glass, sludge, concrete, etc. Upland areas are compacted as well, due to heavy equipment use.**
  - B. Schematic drawing of soils profile and spatial distribution. **See previous statement (Section V Part A).**
  - C. Soil amendment details. **Six inches of clean topsoil will be added. Plants will be fertilized with slow-release Osmocote 10-10-10. Ten grams (10g) will be added to each hole for marsh grasses.**
  - D. Sedimentation and erosion control plan. **Appendix B. Sheet 4 - Grading/Erosion and Sediment Control, Sheet 7 - Erosion Control Details, Appendix E. Specifications.**
  - E. Fertility sampling (on mitigation site and on RE if applicable) and discussion of fertility results relative to the needs and requirements of the plantings proposed. **Soil samples from twelve locations on the site were sent to the North Carolina Department of Agriculture Agronomic Division Laboratory. One near surface sample was taken in the on-site upland, one in the freshwater wetland area, and one in the reference tidal marsh. The final three near surface samples were taken in the on-site tidal marsh. Six more samples were taken in the unconsolidated fill at a depth that approximately corresponds to the proposed grade. Nutrient levels are sufficient to support vegetation, however, six inches of clean, limed topsoil will be added along with slow-release Osmocote 10-10-10 fertilizer to promote healthy growth of the plants. Appendix G. Soil Test Report.**
  - F. Discussion of appropriateness of soils for the target vegetation and wetland. **Clean topsoil will be brought in and fertilized to promote good initial growth of the vegetation. Over time, the new hydrology will allow the wetland to build up organic materials on its own.**
  - G. If PC farmland is used for a site, a discussion of presence, impacts, and remedies for plow pans, field crowns, herbicide residues and carryover, and the drainage system imposed on the farmland. N/A

VI. Hydrology Plans.

- A. A description (written and shown on plans) of the existing water regime on the site, including water budget, sources, volume, velocity, duration and frequency of inundation and/or saturation, drainage area, seasonal highs and lows for each source, rating of each source as primary, secondary, etc., and average depths of surface and/or subsurface water. **The primary source of hydrologic influence is Wilson Bay. The tidal creek will extend and restore the hydrologic connection of the wetland with the bay. Appendix H. Tide gage data.**
- B. Stream gage/staff gage data and monitoring well data where flooding provides hydrologic input to the site. **Appendix H. Tide gage data.**
- C. Field verification of hydrologic regime. **Reference marsh and tide gage data.**
- D. Depth to water table and dates and methods of measurement with map showing locations of measurements. **Tidal data only.**
- E. Duration of water table within 12 inches of the surface of the ground in consecutive days and dates and methods of measurement (including map showing variations across site). **See jurisdictional wetlands on Appendix B. Sheet 3 - Existing Topography and Demolition.**
- F. Map of stream channels, dimensions, and configuration. **See tidal creek on Appendix B. Sheet 4 - Grading/Erosion and Sediment Control, Sheet 5 - Profile/Cross-Sections, Sheet 7 - Erosion Control Details.**
- G. Modeling and assumptions, including highs, lows, and averages. **Assumptions include low rainfall inputs, however, when rainfall does occur the New River tends to be flashy. Based on the reference marsh vegetation, a small adjustment was made to the tide data.**
- H. Discussion of water budget regarding its appropriateness for the targeted wetland. **Based on the tide data, a tidal influence will occur in the brackish marsh area. The salt shrub area will be intermittently wet based upon its elevation.**
- I. Description, location, and plans of any water control structures and devices. **The tide gate is located on Appendix B. Sheet 4 - Grading/Erosion and Sediment Control, and Sheet 7 - Erosion Control Details.**

VII. Stream Plans - All plans for stream restoration shall be developed in accordance with Rosgen methodologies and/or in consultation with the N.C. Wildlife Resources Commission. **N/A**

VIII. Monitoring Plan.

- A. Detailed description of success criteria for vegetation, soils, hydrology, and functions, including timelines and targets to be met relative to the timeline. Include a discussion of why the success criteria are appropriate and will measure success. **Successful revegetation will be realized when 75% vegetative coverage is attained throughout the site and the plants have survived for five years. Groundwater levels and soil temperature will be measured to determine the site's new hydrologic regime. As per the US Army Corps of Engineers Wetland Delineation Manual (1987), an area is considered to have an aquic regime if the water level is within 12" of the surface for 5% of the growing season. The growing season is defined as the portion of the year when soil temperature at 19.7 inches below the surface is higher than biological zero (5°C). Vegetation establishment is an important factor in promoting appropriate wetland functions and sustainability of the site. Soils should consist of 6" of stable topsoil, properly compacted. It is important to monitor erosion, because severe loss of sediment could lead to the flooding out of the marsh. Appendix I. "Wilson Bay Wetland Restoration Phase I - Monitoring Plan."**
- B. Detailed description of methods of measuring success criteria, including contractors and individuals and their qualifications for collecting data and performing monitoring measures. **The NC Wetlands Restoration Program and BLUE: Land, Water, Infrastructure, PA will be conducting the monitoring. Vegetation monitoring will be led by a trained biologist. Approximately 1% of the total area of each vegetation community type will be assessed annually to determine overall vegetation status. Vegetation species, percentage survival and percent cover, as well as overall condition when compared to the planting plan (Appendix B. Sheet 6) will be assessed using predetermined plots. Quick visual assessments of the remaining area will also be conducted to insure that no severely impaired vegetation, bare spots, or large communities of invasive plants exist. Water levels will be assessed using two monitoring wells, and soil temperature will be monitored using a buried thermocouple. Appendix I. "Wilson Bay Wetland Restoration Phase I - Monitoring Plan."**
- C. "As-built" report within 30 days of completion of the initial construction and planting. **Appendix J. "Map of a Topographic Survey of the North Carolina Wetlands Restoration Program Wilson Bay (Sturgeon City) Wetland Restoration Project (Phase I)"**
- D. Observations and measurements of natural regeneration on the site as opposed to the constructed and planted conditions. **Actual measurements have not been completed at the site yet. Brief observations to date indicate wetland vegetation growth is advancing as expected.**

- E. Detailed description of monitoring schedule.
  - Year 1 Post-Construction monitoring - September 2001**
  - Year 2 Post-Construction monitoring - September 2002**
  - Year 3 Post-Construction monitoring - September 2003**
  - Year 4 Post-Construction monitoring - September 2004**
  - Year 5 Post-Construction monitoring - September 2005**
  
- F. Fauna monitoring methods and periods. N/A
  
- G. Timetable for reporting monitoring results and to whom reports are made.
  - Monitoring reports will be submitted to N.C. Wetlands Restoration Program no more than two months after the monitoring field visit is complete each year (November, years 1 through 5).**
  
- IX. Maintenance and Contingency Plans. **Appendix F. Wilson Bay Wetland Restoration - Phase I Management Plan.**