

ANNUAL REPORT FOR 2006



**Sawmill Mitigation Site
Craven County
TIP No. B-2531WM**



Prepared By:
Natural Environment Unit & Roadside Environmental Unit
North Carolina Department of Transportation
January 2007

TABLE OF CONTENTS

SUMMARY	1
1.0 INTRODUCTION	2
1.1 Project Description	2
1.2 Purpose	2
1.3 Project History	3
2.0 HYDROLOGY	5
2.1 Success Criteria	5
2.2 Hydrologic Description	5
2.3 Results of Hydrologic Monitoring	5
2.3.1 Site Data	5
2.3.2 Climatic Data	7
2.4 Conclusions	7
3.0 VEGETATION	10
3.1 Success Criteria	10
3.1.1 Bottomland Hardwood Area	10
3.1.2 Marsh Area	10
3.2 Description of Planted Areas	10
3.3 Results of Vegetation Monitoring	11
3.4 CONCLUSIONS	13
3.4.1 Bottomland Hardwood Area	13
3.4.2 Marsh Area	13
4.0 OVERALL CONCLUSIONS/RECOMMENDATIONS	13

LIST OF FIGURES

Figure 1. Site Location Map 4
Figure 2. Gauge Location Map 6
Figure 3. 2006 Hydrologic Monitoring Gauge Results 8
Figure 4. 30-70 Percentile Graph 9

LIST OF TABLES

Table 1. Hydrologic Monitoring Results 7
Table 2. Vegetative Monitoring Statistics (Hardwood Areas) 11
Table 3. Vegetative Monitoring Statistics (Marsh Areas) 12

APPENDICES

- APPENDIX A GAUGE DATA GRAPHS
- APPENDIX B PHOTO AND VEGETATION PLOT LOCATIONS, SITE PHOTOS

SUMMARY

The following report summarizes the monitoring activities that have occurred in the 2006-year at the Sawmill Mitigation Site. The 2006-year represents the fourth year of hydrology and vegetation monitoring following construction. The site must demonstrate hydrologic and vegetation success for a minimum of five years or until the site is deemed successful. The site was constructed to serve as mitigation for impacts associated with the US17 Neuse River Bridge in New Bern.

In May 2003, surface water and groundwater gauges were installed to monitor hydrology on the site. Three separate gauge sets, each with one surface and one groundwater gauge, were positioned on the mitigation site. There are also two reference gauge sets that were installed prior to construction. One reference set is located offsite and the other set is located directly adjacent to the constructed site, within the preservation area.

Hydrologic success criteria are based on the approved mitigation plan and require that the site demonstrate hydrologic frequency, duration, and depth consistently within 10% of the hydrology of the reference areas. The 2006-year represents the fourth year of hydrologic monitoring for the Sawmill Mitigation Site. The three groundwater restoration gauges were compared to the two existing reference gauges. Reference gauge S-GW2 experienced numerous gauge malfunctions; therefore it was not used for comparison with the three-groundwater restoration gauges. Each of the groundwater restoration gauges indicated that hydrology was within 10% of reference gauge S-GW1. Also, the three surface water gauges indicated inundation patterns similar to that of Reference Gauge S-SG2.

Vegetation monitoring in the hardwood area yielded 534 trees per acre. This average is above the minimum success criteria of 320 trees per acre. Supplemental planting of swamp blackgum in January 2004 increased the counts in each plot. For the marsh grass area, the target species and scale values were 95% and 4.2, respectively.

Based on the results from the fourth year of monitoring, NCDOT will continue to monitor vegetation and hydrology at the Sawmill Mitigation Site.

1.0 INTRODUCTION

1.1 Project Description

The Sawmill Mitigation Site serves (entirely) as mitigation for the US17 Neuse River Bridge in New Bern (Figure 1). Situated adjacent to the new bridge alignment, the 4.07-acre site includes both preservation and restoration of brackish tidal marsh as well as tidal cypress-gum swamp. Reference areas, both onsite and offsite, are utilized to provide reference data for restoration monitoring.

1.2 Purpose

In order to demonstrate successful mitigation, hydrologic and vegetation monitoring must be conducted for a minimum of five years or until the site is deemed successful. Vegetation success criteria are based on the National Marine Fisheries Service guidelines. Hydrologic success criteria are based on the approved mitigation plan and require that the site demonstrate hydrologic frequency, duration, and depth consistently within 10% of the hydrology of the reference areas. Included in this report are analyses of hydrologic and vegetation-monitoring results, discussions of local climate conditions throughout the growing season, and site photographs.

1.3 Project History

2002	Reference Gauges Installed
March 2003	Site Constructed
April 2003	Site Planted
May 2003	Monitoring Gauges Installed
May-November 2003	Hydrologic Monitoring (Year 1)
July 2003	Hardwood Vegetation Monitoring (Year 1)
July 2003	Marsh Vegetation Monitoring (Year 1)
March-November 2004	Hydrologic Monitoring (Year 2)
June 2004	Hardwood Vegetation Monitoring (Year 2)
June 2004	Marsh Vegetation Monitoring (Year 2)
March-November 2005	Hydrologic Monitoring (Year 3)
June 2005	Hardwood Vegetation Monitoring (Year 3)
June 2005	Marsh Vegetation Monitoring (Year 3)
March-November 2006	Hydrologic Monitoring (Year 4)
June 2006	Hardwood Vegetation Monitoring (Year 4)
June 2006	Marsh Vegetation Monitoring (Year 4)

2.0 HYDROLOGY

2.1 Success Criteria

The hydrologic success criteria established for the Sawmill Mitigation Site, as stipulated in the approved mitigation plan and subsequent revisions, require that the site demonstrate hydrologic frequency, duration, and depth consistently within 10% of the hydrology of the reference areas. The site-specific criteria vary from current federal guidelines that require a site to be inundated or saturated (within 12" of the surface) by surface or groundwater for a consecutive period amounting to 12.5% of the growing season.

The growing season in Craven County begins on March 18 and ends November 14. The dates correspond to a 50% probability that air temperature will drop to 28° after March 18 and before November 14¹; thus, the growing season is 240 days. Local climate must represent normal conditions for the area.

2.2 Hydrologic Description

Wind-driven tides are the primary hydrologic input at the Sawmill Site; therefore, three sets of gauges were installed within the site's restoration area (Figure 2) in May 2003. Each set includes one surface water gauge and one groundwater-monitoring gauge. There are also two reference gauge sets that were installed prior to construction. One reference set is located offsite and the other set is located directly adjacent to the constructed site, within the preservation area. No rain gauge is located on the site, so rainfall data (supplied by the NC State Climate Office) from an official weather station in New Bern is used to supplement the site data. The surface gauges record surface water levels every three hours, while the groundwater gauges record water levels on a daily basis.

2.3 Results of Hydrologic Monitoring

2.3.1 Site Data

The maximum number of consecutive days that saturation occurred within 12 inches of the ground surface was determined for each groundwater-monitoring gauge. This number was converted into a percentage of the 242-day growing season (March 18 – November 14). Table 1 provides the 2006 hydrologic results; Figure 3 is a graphical representation of these results. Appendix A includes graphs of the data recorded at each groundwater and surface water gauge. Daily rainfall events recorded at the official weather station in New Bern are included on each of the groundwater gauge plots.

¹ Soil Conservation Service, Soil Survey of Craven County, North Carolina, 1989.

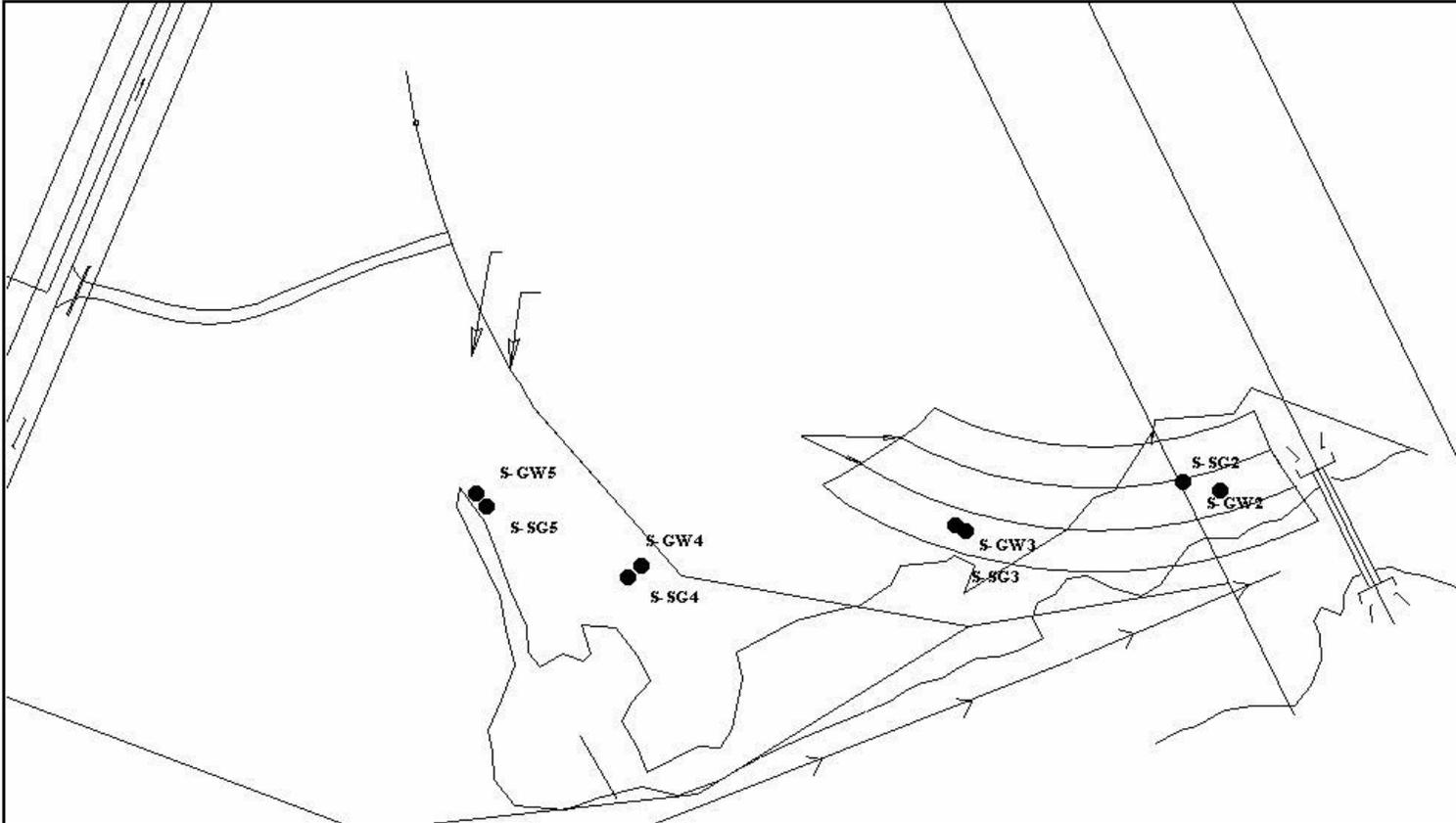


Figure 2. Gauge Location Map



↑
N
↓
Not to Scale

Table 1. Hydrologic Monitoring Results

Monitoring Gauge	Within 10%	Actual %	Dates of Success
S-GW1 (Offsite) (REF)	×	97.9	March 23-Nov 14
S-GW2 (Onsite) (REF)	×	68.2	March 18-August 29
S-GW3	×	100	March 18-Nov 14
S-GW4	×	100	March 18-Nov 14
S-GW5	×	100	March 18-Nov 14

Shaded gauges are reference gauges.

Specific Gauge Problems:

- S-GW2 (Onsite Reference): The gauge experienced numerous malfunctions (August 30-November 30).

2.3.2 Climatic Data

Figure 4 is a comparison of the 2006 monthly rainfall to the historical precipitation (collected between 1975 and 2006) for New Bern, North Carolina. This comparison gives an indication of how 2006 relates to historical data in terms of climate conditions. The NC State Climate Office provided all local rainfall information.

For the 2006-year; July, August, September, and November experienced above average rainfall. The months of January, February, March, and May recorded below average rainfall, while April, June, and October recorded average rainfall. Overall, 2006 experienced an average rainfall year.

2.4 Conclusions

The 2006-year represents the fourth year of hydrologic monitoring for the Sawmill Mitigation Site. The three groundwater restoration gauges were compared to the two existing reference gauges. Reference gauge S-GW2 experienced numerous gauge malfunctions; therefore it was not used for comparison with the three-groundwater restoration gauges. Each of the groundwater restoration gauges indicated that hydrology is within 10% of reference gauge S-GW1. Also, the three surface water gauges indicated inundation patterns similar to that of Reference Gauge S-SG2.

NCDOT will continue to monitor the Sawmill Mitigation Site for hydrology.

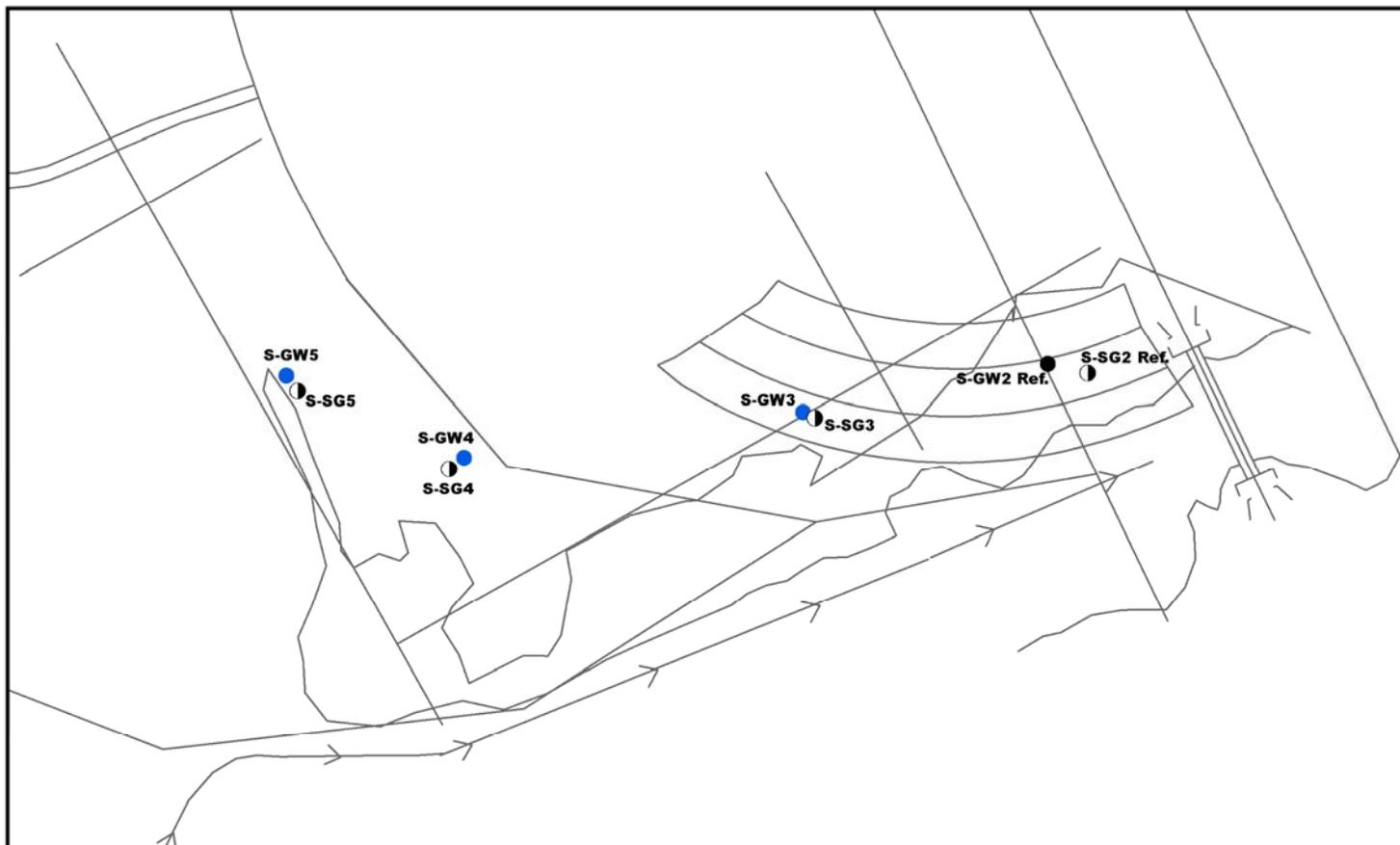


Figure 3. 2006 Hydrologic Monitoring Gauge Results



Hydrology Results

- Reference Gauge
- Surface Gauge
- Hydrology Within 10% criteria
- Hydrology Outside of 10% criteria

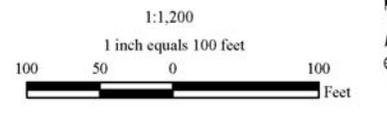
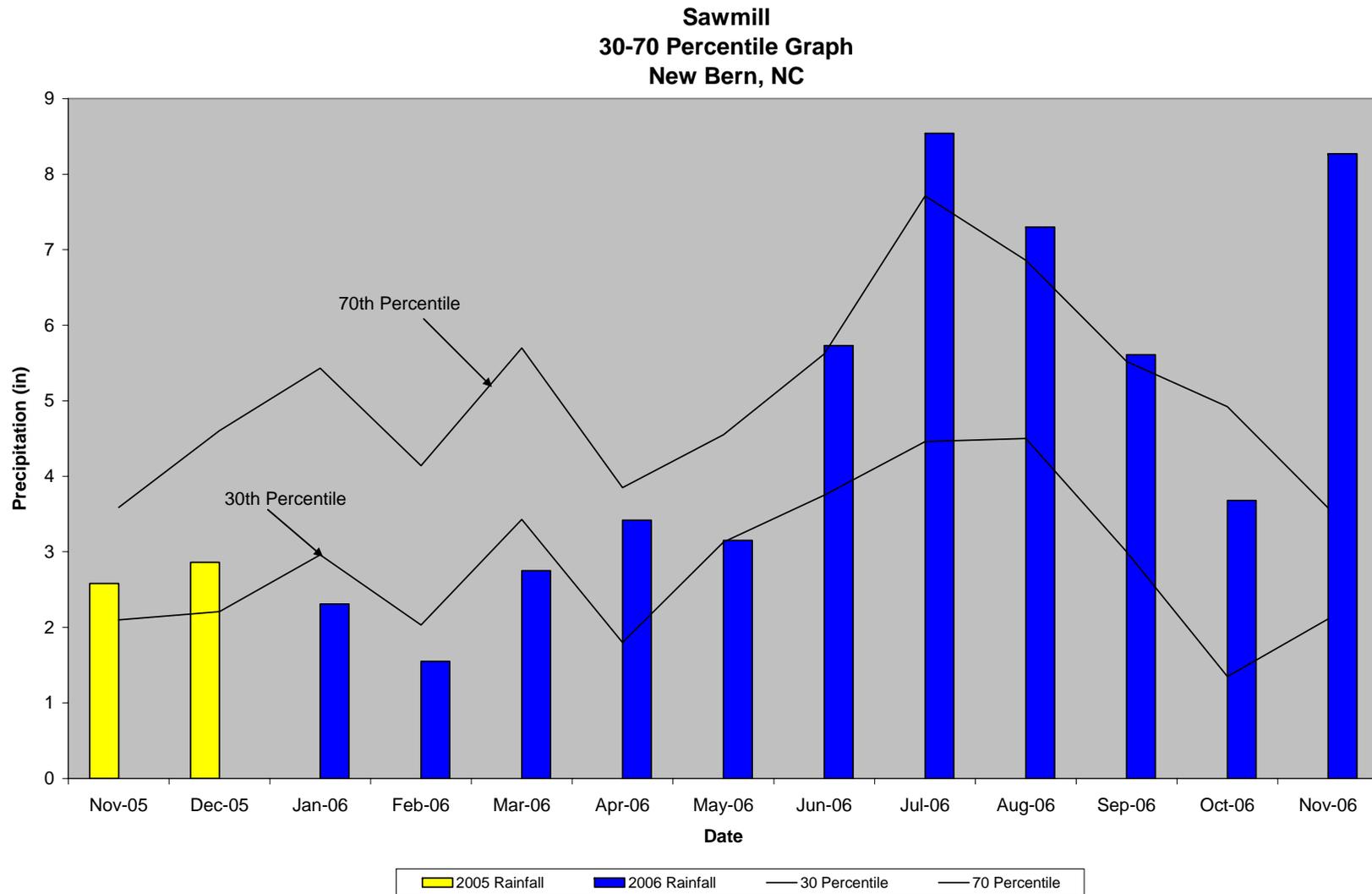


Figure 4. 30-70 Percentile Graph



3.0 VEGETATION: SAWMILL MITIGATION SITE (YEAR 4 MONITORING)

3.1 Success Criteria

3.1.1 Bottomland Hardwood Area

The success criteria state that at least 320 stems per acre must survive after the completion of the third growing season and 240 stems per acre after the fifth growing season. If the desired vegetation has not been established, NCDOT will notify the appropriate agencies and will implement corrective measures.

3.1.2 Marsh Grass Area

The vegetative success of the marsh portion of the wetland site will be determined in accordance with NMFS Guidelines. Monitoring plots found to be located within the open water channel will not be evaluated, and will not count toward the final count of plots. The vegetation component of the wetland site will be deemed successful if the following criteria are met:

1. At year five, the average of all plots should have a scale value of 5 (>75% vegetative cover) consisting of wetland herbaceous species, not including any invasive species.
2. A minimum of 70% of the plots shall contain the target (planted) species.

3.2 Description of Species

The following tree species were planted in the Wetland Restoration Area:

Taxodium distichum, Bald cypress

Fraxinus pennsylvanica, Green Ash

Quercus lyrata, Overcup Oak

Nyssa aquatica, Water Tupelo

Nyssa sylvatica var. *biflora*, Swamp Blackgum

The following marsh grass species was planted in the Marsh Grass Area:

Spartina cynosuroides, Big Cordgrass

3.3 Results of Vegetation Monitoring

Table 2. Vegetative Monitoring Statistics (Hardwood Areas)

Plot #	Baldcypress	Green Ash	Overcup Oak	Swamp Blackgum	Water Tupelo	Total (4 year)	Total (at planting)	Density (Trees/Acre)
1	9	7		3	17	36	48	510
2	22	9	3	5	2	41	50	558
Average Density (Trees/Acre)								534

Site Notes: Other species noted: *Pluchea* sp., woolgrass, sedge and *Juncus* sp. Heavy cattails and black willow noted on site. Overcup oaks were noted around the perimeter of plot 1.

Table 3. Vegetative Monitoring Statistics (Marsh Areas)

Plot #	Scale Factor	Big Cordgrass	Frequency	Comments
1	4.0	X	X	
2	4.0	X	X	<i>Juncus</i> sp., Cattails, Black Willow
3	5.0	X	X	Cattails, Black Willow
4	2.0	X	X	Cattails
5	Out of Bounds			GPS locating plot on fill slope
6	5.0	X	X	<i>Juncus</i> sp., Fennel
7	3.0	X	X	<i>Juncus</i> sp., Black Willow
8	3.0	X	X	Black Willow
9	2.0	X	X	
10	5.0	X	X	<i>Juncus</i> sp., Black Willow
11	5.0	X	X	Cattails
12	5.0	X	X	Vines
13	4.0	X	X	<i>Juncus</i> sp., Black Willow
14	5.0	X	X	<i>Juncus</i> sp., Black Willow
15	5.0			<i>Juncus</i> sp., Cattails
16	4.0	X	X	Cattails
17	5.0	X	X	Vines
18	5.0	X	X	<i>Juncus</i> sp.
19	4.0	X	X	
20	5.0	X	X	<i>Juncus</i> sp., Cattails, Black Willow
Frequency (Percentage of Plots w/ Desired Species)			95.0%	
Sum Scale Value			80.0	
Total Number of Plots			19	
Vegetative Cover (Scale Value)			4.2	

Site Notes: The following species were also noted in the monitoring plots. The number of plots the species were found in is following the species in parentheses (i.e. black willow was noted in 8 plots): *Juncus* sp. (9), fennel (1), cattail (7), and vines (2).

3.4 Conclusions

3.4.1 *Bottomland Hardwood Area*

There were two hardwood vegetation monitoring plots established throughout the 2.4 acre planting area. Supplemental planting of swamp blackgum occurred throughout the site in January 2004. Therefore, the average planting counts increased for each plot. The 2006 vegetation monitoring of the site revealed an average tree density of 534 trees per acre. This average is well above the minimum success criteria of 320 trees per acre.

3.4.2 *Marsh Area*

- Percent Frequency of Target Species (planted species) **95%**
Frequency of 70% required.
- Vegetative Cover Scale Value **4.2**
Scale Value of 5 required for year 5.

Of the 4.07 acres of this site, approximately 0.78 acres involved marsh grass planting. There were twenty random plots established throughout the planting area. These plots were located with GPS. Based upon the percent frequency and the scale value, the marsh grass area is trending toward success after the fourth year of monitoring.

4.0 OVERALL CONCLUSIONS/RECOMMENDATIONS

The 2006-year represents the fourth year of hydrologic monitoring for the Sawmill Mitigation Site. The three groundwater restoration gauges were compared to the two existing reference gauges. Reference gauge S-GW2 experienced numerous gauge malfunctions; therefore it was not used for comparison with the three-groundwater restoration gauges. Each of the groundwater restoration gauges indicated that hydrology is within 10% of reference gauge S-GW1. Also, the three surface water gauges indicated inundation patterns similar to that of Reference Gauge S-SG2.

Vegetation monitoring in the hardwood area yielded 534 trees per acre. This average is above the minimum success criteria of 320 trees per acre. Supplemental planting of swamp blackgum in January 2004 increased the counts in each plot. For the marsh grass area, the target species and scale values were 95% and 4.2, respectively.

NCDOT will continue to monitor the Sawmill Mitigation Site for vegetation and hydrology.

APPENDIX A
GAUGE DATA GRAPHS

APPENDIX B

PHOTO AND VEGETATION PLOT LOCATIONS, SITE PHOTOS

Sawmill



Photo 1



Photo 2



Photo 3



Photo 4

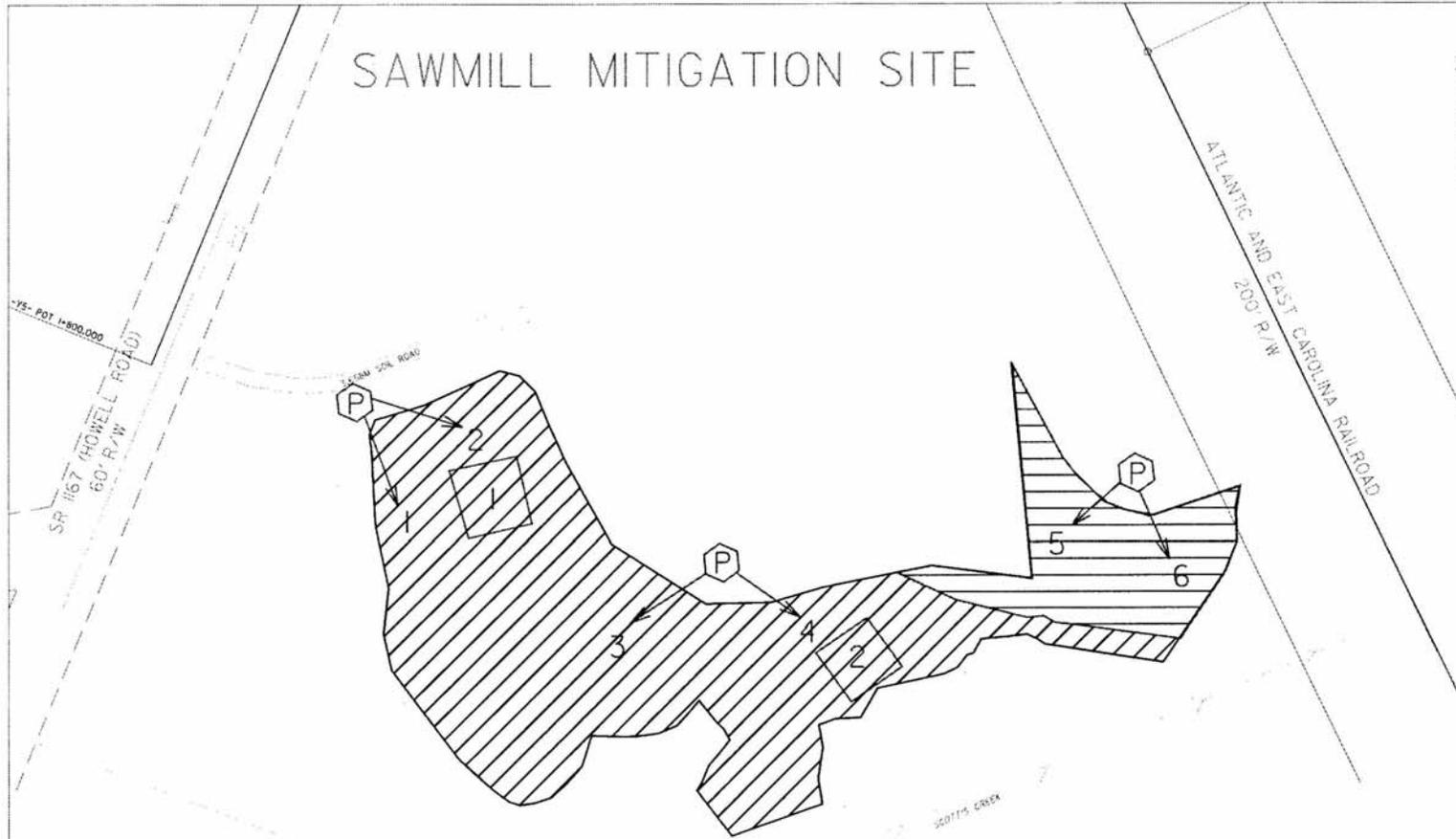


Photo 5



Photo 6

SAWMILL MITIGATION SITE



-  PLOT LOCATIONS
-  PHOTO LOCATIONS

-  Tidal Cypress/Gum Swamp
-  Tidal Marsh Area

Figure No.	Figure Title	Scale
1	Site Map	1" = 100'
2	Plot Locations	1" = 100'
3	Photo Locations	1" = 100'

Project Name: Sawmill Mitigation Site
 Client: [Redacted]
 Date: [Redacted]



