ANNUAL REPORT FOR 2003

ABC Wetland Mitigation Site
Beaufort County
Project No. 8.T221801
TIP No. R-2510WM

Prepared By:
Office of Natural Environment & Roadside Environmental Unit
North Carolina Department of Transportation
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SUMMARY

The following report summarizes the monitoring activities that have occurred in the past year at the ABC Mitigation Site. The site must be monitored to show successful mitigation and must demonstrate both vegetation and hydrologic success for a minimum of five years or until the site is deemed successful. Completed in January 2001, the 187-acre site will serve as mitigation for wetland impacts within the coastal plain region of the Tar-Pamlico River Basin and provides non-riverine wet hardwood forest restoration. In order to restore wetland conditions, the existing site was altered by constructing depressions and installing ditch plugs as well as by backfilling material and scarifying wetland soil surfaces. Trees were planted to facilitate establishment of natural communities.

Twenty-nine groundwater-monitoring gauges are used to record daily hydrologic conditions. Eight of these gauges are situated within an offsite reference area; data from these reference gauges are used as a comparison if data from the restored area does not meet jurisdictional success criteria. An onsite rain gauge records daily rainfall events to monitor the site's response to rainfall. Monthly rainfall data, measured at the closest official weather station, was compared to historical rainfall totals in order to determine relative climate conditions during the growing season.

For the 2003 monitoring year, twenty-eight of the twenty-nine groundwater gauges showed saturation in excess of the 12.5% hydrologic success criterion (only reference gauge RF2 at 11.3% did not meet the criterion). Overall, onsite gauges exhibited similar results or exceeded the saturation periods recorded in the reference community.

Approximately 140.7 acres of the site were planted with wetland vegetation. Thirteen permanent vegetation plots are used in annual vegetation monitoring; success criteria states that at least 320 trees/acre must be surviving after three years, with at least 260 trees/ acre surviving at the end of year five. For 2003, the 13 permanent vegetation plots revealed an average density of 527 trees per acre, which is well above the minimum success criteria of 320 trees per acre.

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

1.0 INTRODUCTION

1.1 Project Description

The North Carolina Department of Transportation (NCDOT) established the ABC Wetland Mitigation Site to provide up-front wetland mitigation for unavoidable transportation-related wetland impacts in the coastal plain region of the Tar-Pamlico River Basin. The 75-hectare (184-acre) tract is situated northeast of Washington in Beaufort County, North Carolina (Figure 1).

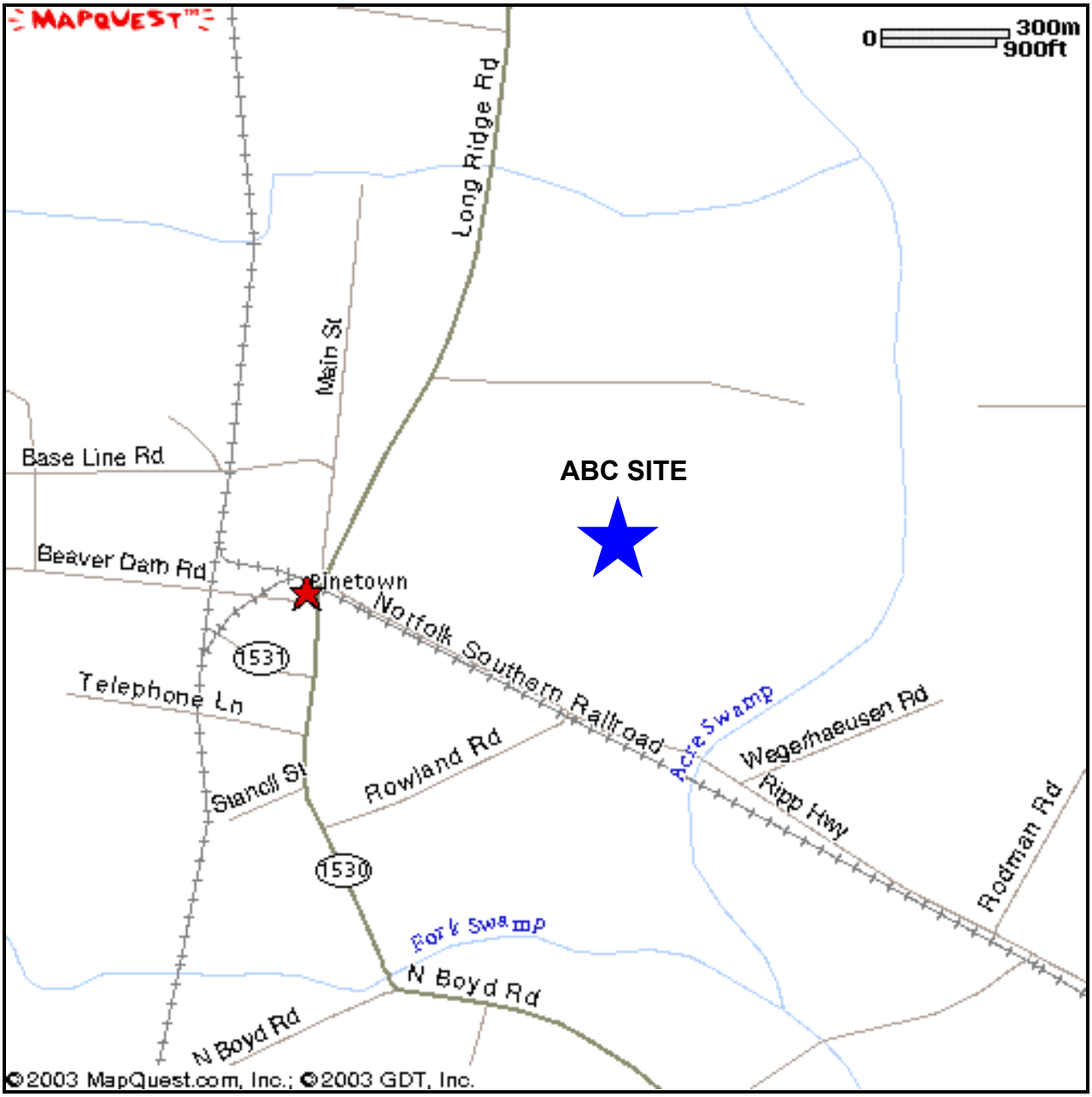
The site had been cleared, ditched, and drained, with wetlands effectively removed to facilitate agricultural production and to convey runoff into Acre Swamp located along the southeastern border of the site. Wetland mitigation activities were designed to restore wetland features and functions similar to those exhibited by reference wetlands in the region. Site alterations, designed to restore characteristic wetland soil features and groundwater wetland hydrology, include depression construction (B-horizon contouring), impervious ditch plug construction, ditch backfilling, field crown removal, and ripping/scarification of wetland soil surfaces. Following construction, the site was planted with native vegetation characteristic of the target ecosystem.

Pre-construction investigations suggested that the site would support the following communities: 37 hectares (92 acres) of restored non-riverine forested wetlands; 7 hectares (19 acres) of enhanced non-riverine wetland systems; and approximately 1,252 meters (4,107 feet) of stream enhancement (including streamside plantings and riparian forest buffer restoration). In addition, groundwater recharge was expected to improve within the remaining 31 hectares (76 acres) of uplands and streamside management areas. These areas were estimated based on soil types, local topographic features, elevation and slope, landscape position, and groundwater model forecast (DRAINMOD).

1.2 Purpose

In order to demonstrate successful mitigation, a site must be monitored for at least five years or until success criteria are met. Monitoring is conducted by installing both groundwater and surface water gauges to establish a hydrologic record, by placing permanent vegetation sampling plots to record establishment of woody vegetation, and by utilizing photographs as visual documentation of the site. This document summarizes the results of the monitoring program activities at the ABC Wetland Mitigation Site for the 2003 growing season, the third year that monitoring has been conducted on the site.

Figure 1. ABC Site Location Map



1.3 Project History

January 1997	Site Identification
June 1999	Detailed Mitigation Design Study
Sept. 2000-Jan. 2001	Site Construction
March 2001	Site Planted
March-November 2001	Hydrologic Monitoring (1 yr.)
August 2001	Vegetation Monitoring (1 yr.)
March- November 2002	Hydrologic Monitoring (2 yr.)
August 2002	Vegetation Monitoring (2 yr.)
March – November 2003	Hydrologic Monitoring (3 yr.)
June 10, 2003	Agency Site Visit
August 2003	Vegetation Monitoring (3 yr.)

1.4 Debit Ledger

As of 2003, no debits have been made from the ABC Mitigation Site. It is expected that debits will be authorized once the site yields several years of successful hydrologic conditions and vegetation growth.

2.0 HYDROLOGY

2.1 Success Criteria

Hydrologic success criteria for the ABC Mitigation Site are based on federal guidelines for mitigation as described in the 1987 U.S. Army Corps of Engineers (COE) Wetlands Delineation manual. These guidelines suggest that an area must be inundated or saturated (within 12 inches of the surface) by surface or groundwater for 12.5% of the growing season (consecutive days). However, areas inundated between 5% and 12.5% of the growing season may warrant jurisdictional classification depending upon factors such as the presence of hydrophytic vegetation and hydric soils.

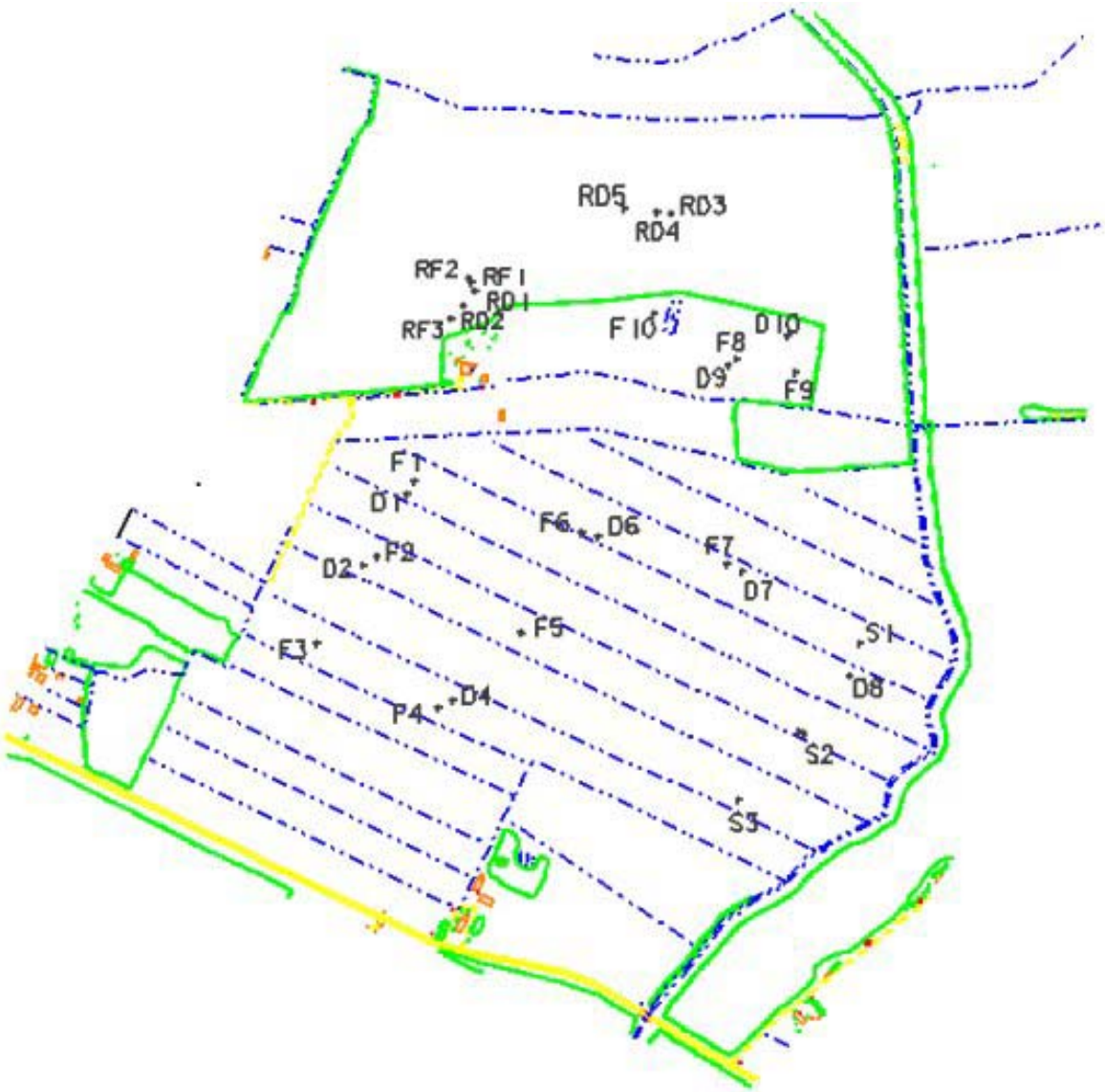
The average wetland hydroperiod for this site is expected to exhibit a gradual increase from 8% of the growing season, immediately after the farm land is abandoned and the drainage structures are removed, to as much as 20% under steady state forest conditions. Evaluation of success criteria will be supplemented by sampling and data comparison between reference wetland sites. One reference community was monitored during 2003 and is located approximately 0.20 miles north of the site.

The growing season for Beaufort County is defined in the Beaufort County Soil Survey as the period between March 13 and November 25 (256 days, USDA 1995). In order to meet minimum hydrologic regulatory success (12% of the growing season), the groundwater table must remain within 12 inches of the surface for 32 consecutive days. In the event that the site does not meet jurisdictional success criteria, the hydrologic data from the site will be compared to that from the reference wetland.

2.2 Hydrologic Description

Following construction, twenty-one groundwater gauges were placed on the site in accordance with specifications in U.S. Army Corps of Engineers', Installing Monitoring Recorders/Piezometers in Wetlands (WRP Technical Note HY-IA-3.1, August 1993). Sixteen monitoring gauges were installed in 2001 to provide representative coverage within each of the wetland physiographic landscape areas on the site. In 2002, eight additional groundwater gauges were installed on site; three of those gauges were installed in the reference wetland. Currently, eight of the twenty-nine groundwater-gauges are located within the reference wetland, approximately 0.2 miles north of the mitigation site (Figure 2). The groundwater gauges record daily groundwater levels across the site. In addition, an onsite rain gauge records daily rainfall totals; this data is used to see how the groundwater table responds to rainfall events.

Figure 2. Monitoring Gauge Location Map



Micro-topographical features, such as semi-permanently inundated/saturated depressions and swales of various sizes, were created for the purpose of water storage as well as habitat diversity. Eleven gauges (D1, D2, D4, D6, D7, D8, D9, D10, S1, S2, and S3) were placed within saturated depressions, while nine gauges (F1, F2, F3, F4, F5, F6, F7, F8, and F9) were placed in non-depressional areas throughout the site at ground elevation. Eight gauges were placed in similar landscape positions within the reference community. Reference gauges RD1, RD2, RD3, RD4, and RD5 were placed in depressions while gauges RF1, RF2, and RF3 were placed at base elevation.

2.3 Results of Hydrologic Monitoring

2.3.1 Site Data

The maximum number of consecutive days that the groundwater was within twelve inches of the surface was determined for each gauge. This number was converted into a percentage of the 256-day growing season. Table 1 shows the hydrologic results for the 2003 growing season; these results are illustrated in Figure 3.

Appendix A contains a plot of the groundwater depth readings at each monitoring gauge location. The maximum number of consecutive days that the gauge met success above the 12-inch depth is noted on each graph. Data determined to be erroneous was omitted; therefore, some gaps appear in the plots. Precipitation events, recorded at the onsite rain gauge, are included on each graph as bars.

Table 1. 2003 Hydrologic Monitoring Results

Monitoring Gauges		<5%	5%-8%	8%-12.5%	> 12.5%	Actual %	Success Dates
Depressions	D1+				✕	100	March 14-Nov 24
	D2+				✕	83.6	April 25-Nov 24
	D4+				✕	100	March 14-Nov 24
	D6+				✕	100	March 14-Nov 24
	D7+				✕	100	March 14-Nov 24
	D8+				✕	100	March 14-Nov 24
	D9+				✕	39.8	March 14-June 23 Sept 17-Oct 23 October 26-Nov 24
	D10+				✕	41	March 14-June 26 July 3-Sept 1 Sept 13-Nov 24
	S1+				✕	25.4	March 14-May 17 May 19-June 23 July 3-August 29
	S2+				✕	39.5	March 14-June 22 July 14-Sept 2
	S3+				✕	88.7	March 14-October 26
Base Elevation	F1+				✕	100	March 14-Nov 24
	F2+				✕	40.2	March 14-June 24 Sept. 18-Oct 29
	F3+				✕	23.4	March 14-May 12 October 29- Nov 24
	F4+				✕	41.4	March 14-June 27 July 14- August 31 Sept 18- Nov 24
	F5+				✕	70.7	March 14-Sept 10 Sept 12-Oct 24 October 26-Nov 24
	F6+				✕	25.4	March 14-May 17 Sept 18-October 22 October 27-Nov 24
	F7+				✕	42.6	March 14-June 30 July 3-Sept 3 Sept 18-Nov 24
	F8+				✕	23.8	March 14-May 13 May 19-June 13
	F9+				✕	13.7	March 20-April 23 October 29-Nov 17
	F10+				✕	23.8	March 14-May 13 May 19-June 14 October 29-Nov 24
Reference	RD1+				✕	100	March 14-Nov 24
	RD2+				✕	100	March 14-Nov 24
	RD3+				✕	26.2	March 14-May 17 Sept 19-Nov 24
	RD4+				✕	23.4	March 14-May 12 Sept 19-Oct 17

	RD5+				×	23.8	March 14-May 13 Sept 19-Oct 16
	RF1+				×	24.2	March 14-May 14 Sept 19-October 17 October 29-Nov 24
	RF2+			×		11.3	April 25-May 14 Sept 19-October 17 October 29-Nov 24
	RF3+				×	25	March 14-May 16 Sept 19-October 20 October 29-Nov 24

+ Gauge met the success criterion during an average rainfall month (March, August, October, and November).

2.3.2 Climatic Data

The majority of the ABC Site is characterized as a precipitation driven system; the wetland hydroperiod is completely dependent upon local weather patterns. Figure 4 is a comparison of monthly rainfall for the period of November 2002 through November 2003 to historical precipitation (collected between 1972 and 2003) for Washington, North Carolina. The rainfall data for September-November 2003 was collected from the onsite rain gauge. This comparison gives an indication of how 2003 relates to historical data in terms of climate conditions. The NC State Climate Office provided all local rainfall information.

For the 2003-year, November (02'), February, April, May, July, and September experienced above average rainfall. The months of January and June recorded below average rainfall for the site. December (02'), March, August, October, and November experienced average rainfall. Overall, 2003 experienced an average rainfall year.

2.4 Conclusions

Hydrologic data indicates that the ABC Mitigation Site exceeded wetland jurisdictional status for the 2003-monitoring year. Twenty-eight of the twenty-nine gauges (both onsite and reference) exceeded the success criteria of 12.5% of the growing season during an average rainfall year. The site data also correlated well with similar data collected on the reference wetland.

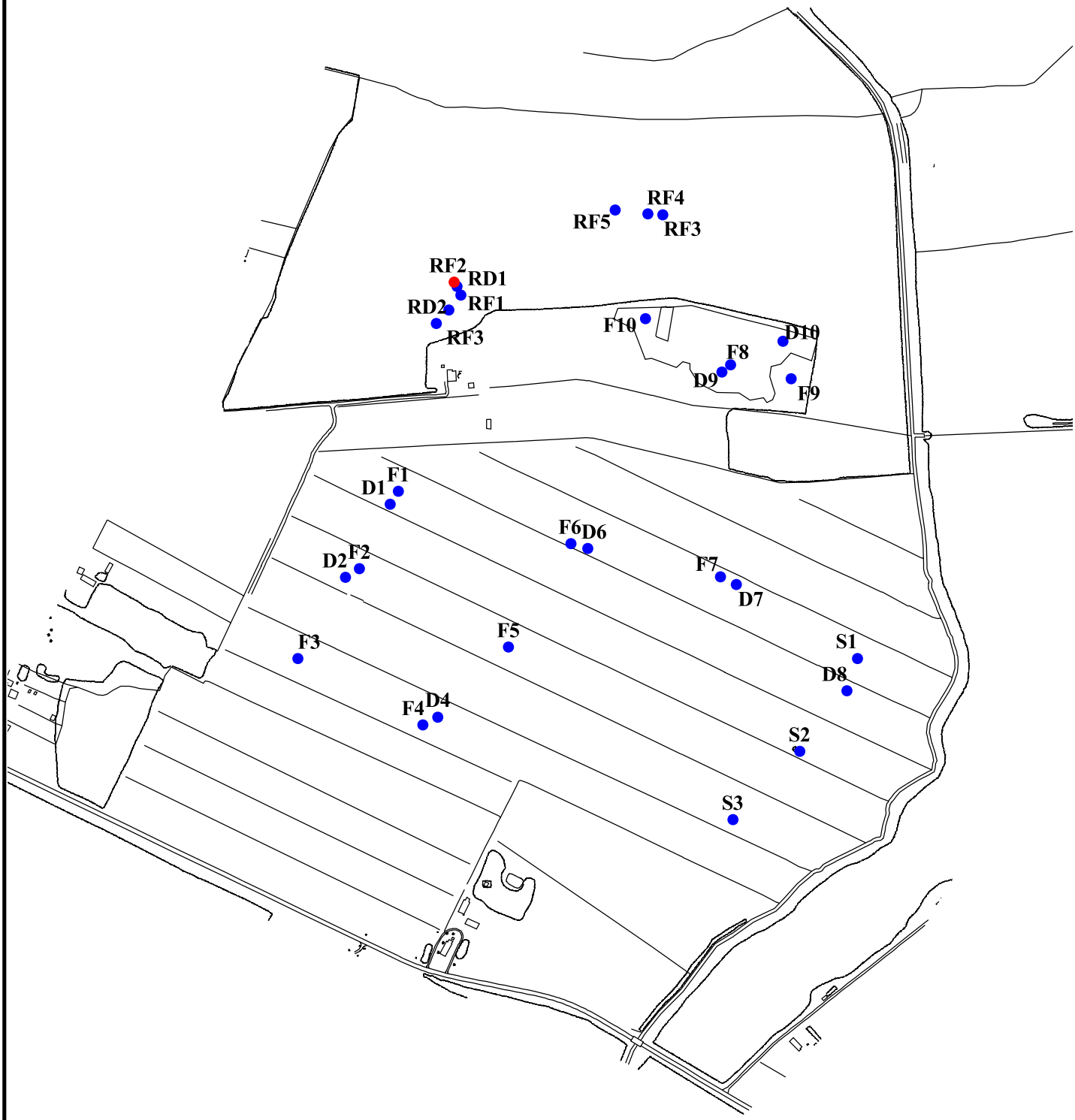


Figure 3. 2003 Hydrologic Monitoring Gauge Results

Hydrology Results

- < 5%
- 5 - 8%
- 8 - 12.5%
- > 12.5%

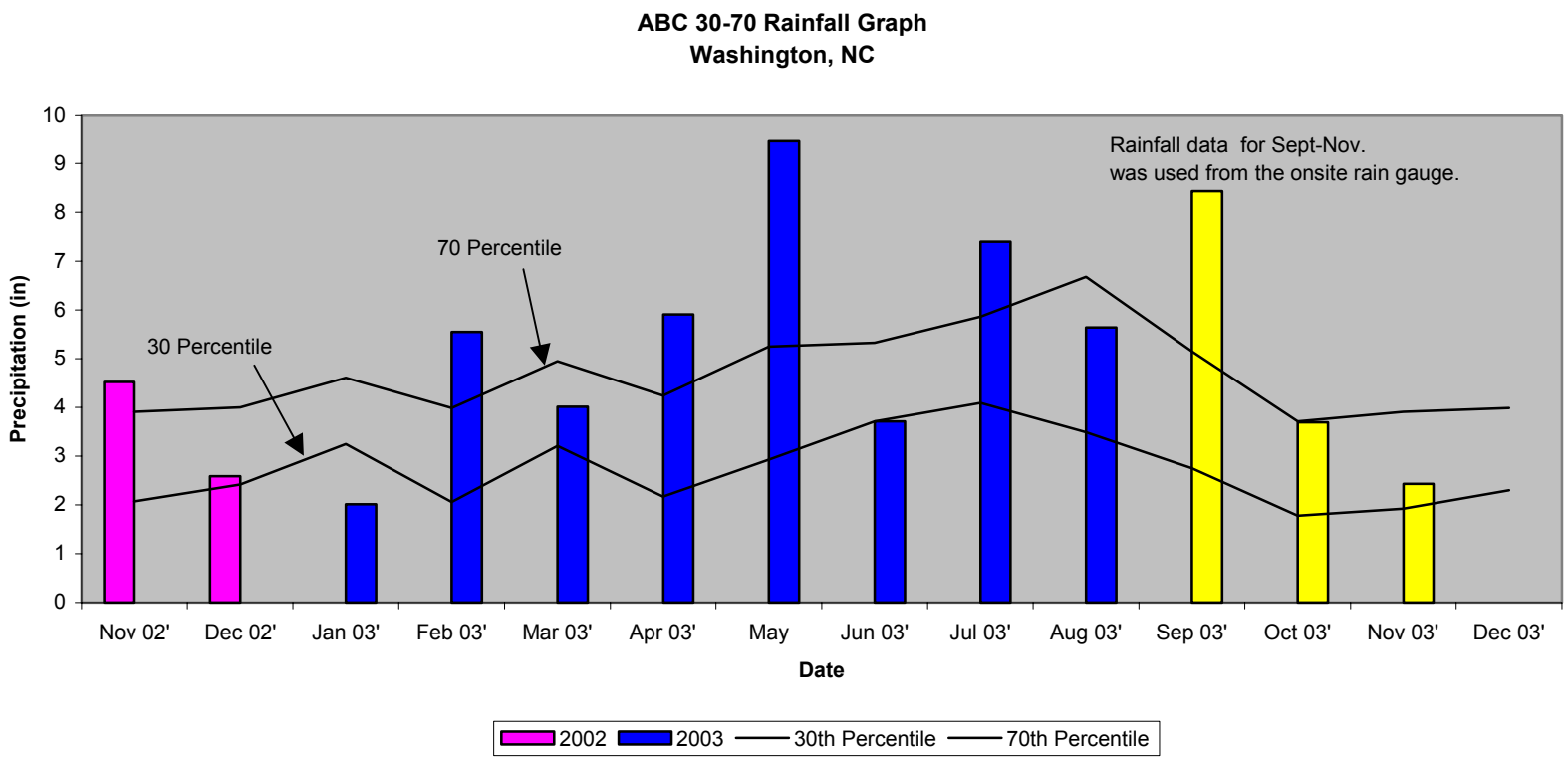
Rain Gauge

Surface Gauge

N

300 0 300 Feet

Figure 4. 30-70 Percentile Graph



3.0 VEGETATION: ABC MITIGATION SITE (YEAR 3 MONITORING)

3.1 Success Criteria

Success criteria state that there must be a minimum of 320 trees per acre living for at least three consecutive years. A minimum of 290 trees per acre must be living at year 4 and a minimum of 260 trees per acre must be living at year 5.

3.2 Description of Species

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

Zone 1: Levee/Streambank Forest

Taxodium distichum, Baldcypress

Nyssa sylvatica var. *biflora*, Swamp Blackgum

Quercus laurifolia, Laurel Oak

Quercus lyrata, Overcup Oak

Quercus phellos, Willow Oak

Betula nigra, River Birch

Zone 2: Riverine Swamp Forest

Taxodium distichum, Baldcypress

Quercus laurifolia, Laurel Oak

Quercus lyrata, Overcup Oak

Quercus phellos, Willow Oak

Fraxinus pennsylvanica, Green Ash

Quercus michauxii, Swamp Chestnut Oak

Zone 3: Mesic Hardwood Forest

Fraxinus pennsylvanica, Green Ash

Quercus michauxii, Swamp Chestnut Oak

Quercus falcata var. *pagodaefolia*, Cherrybark Oak

Liriodendron tulipifera, Tulip Poplar

Quercus rubra, Northern Red Oak

Quercus alba, White Oak

Zone 4: Non-Riverine Wet Hardwood Forest

Nyssa sylvatica var. *biflora*, Swamp Blackgum

Quercus laurifolia, Laurel Oak

Quercus lyrata, Overcup Oak

Quercus phellos, Willow Oak

Fraxinus pennsylvanica, Green Ash

Quercus michauxii, Swamp Chestnut Oak

Zone 5: Dry Mesic Oak/Hickory Forest

Quercus rubra, Northern Red Oak

Quercus alba, White Oak

Carya tomentosa, Mockernut Hickory

Nyssa sylvatica var. *sylvatica*, Blackgum

Carya glabra var. *glabra*, Pignut Hickory

Quercus falcata var. *falcata*, Southern Red Oak

3.3 Results of Vegetation Monitoring

ZONE	Plot #	Baldcypress	Swp. Blackgum	Laurel Oak	Overcup Oak	Willow Oak	River Birch	Green Ash	Swp. Chestnut Oak	Cherrybark Oak	Tulip Poplar	Northern Red Oak	White Oak	Mockernut Hickory	Blackgum	Pignut Hickory	Southern Red Oak	Total (3 year)	Total (at planting)	Density (Tree/Acre)
1	12	11					1		16			3						31	32	659
	13		1	7	11	5			7									31	35	602
									ZONE 1 AVERAGE DENSITY											631
2	10	1			8	5				2								16	32	340
	11	17			6			10										33	33	680
									ZONE 2 AVERAGE DENSITY											510
3	8							7		2		6	6					21	33	433
	9									13	1	5						19	31	417
									ZONE 3 AVERAGE DENSITY											425
4	1		1	2	6	21		1										31	31	680
	2		4			6		2	16									28	34	560
	3	5			8	5		1	7									26	31	570
	4	1			19	4		13	1									38	39	663
	5		1		10	1		19										31	35	602
									ZONE 4 AVERAGE DENSITY											615
5	6											4		2	2	1		9	31	197
	7				2	4						1	4				10	21	32	446
									ZONE 5 AVERAGE DENSITY											322
									TOTAL AVERAGE DENSITY											527

Site Notes:
Zone 1: Other species noted: Goldenrod, *Aster* sp., and fennel. Plots 12 and 13 are 100' x 25' due to the size of the zone.
Zone 2: Other species noted: smartweed, foxtail, fennel, *Aster* sp., ragweed, *Juncus* sp., and *Scirpus* sp. Cattails and standing water were noted in the swales.
Zone 3: Other species noted: pine, lespedeza, fennel, foxtail, briars, and broomsedge.
Zone 4: Other species noted: foxtail, black willow, smartweed, lespedeza,

blackberry, fennel, ragweed, *Juncus* sp., *Aster* sp., *Baccharis* sp., *Panicum* sp., and *Eleocharis* sp.
Zone 5: Other species noted: volunteer overcup oak, heavy fennel, and ragweed.

3.4 Conclusions

Of the 187 acres on this site, approximately 140.7 acres involved tree planting. There were 13 vegetation-monitoring plots established throughout the planting areas. The 2003 vegetation monitoring of the planted areas revealed an average density of 527 trees per acre. This is well above the minimum success criteria of 320 trees per acre.

NCDOT will continue vegetation monitoring at the ABC Mitigation Site.

4.0 OVERALL CONCLUSIONS/ RECOMMENDATIONS

Twenty-eight of the twenty-nine groundwater gauges showed saturation in excess of the 12.5% hydrologic success criterion (only reference gauge RF2 at 11.3% did not meet the criterion). Overall, onsite gauges exhibited similar results or exceeded the saturation periods recorded in the reference community.

For the 2003 vegetation-monitoring year, the thirteen permanent vegetation plots revealed an average density of 527 trees per acre, which is well above the minimum success criteria of 320 trees per acre.

In summary, the ABC Mitigation Site met the success criteria for hydrology and vegetation in the 2003 monitoring year and the site exhibits wetland characteristics similar to those in the reference wetland.

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

APPENDIX A

Gauge Data Graphs

APPENDIX B

Site Photos & Vegetation Plot Map

ABC Mitigation Site

Photo 1

Photo 2

Photo 3

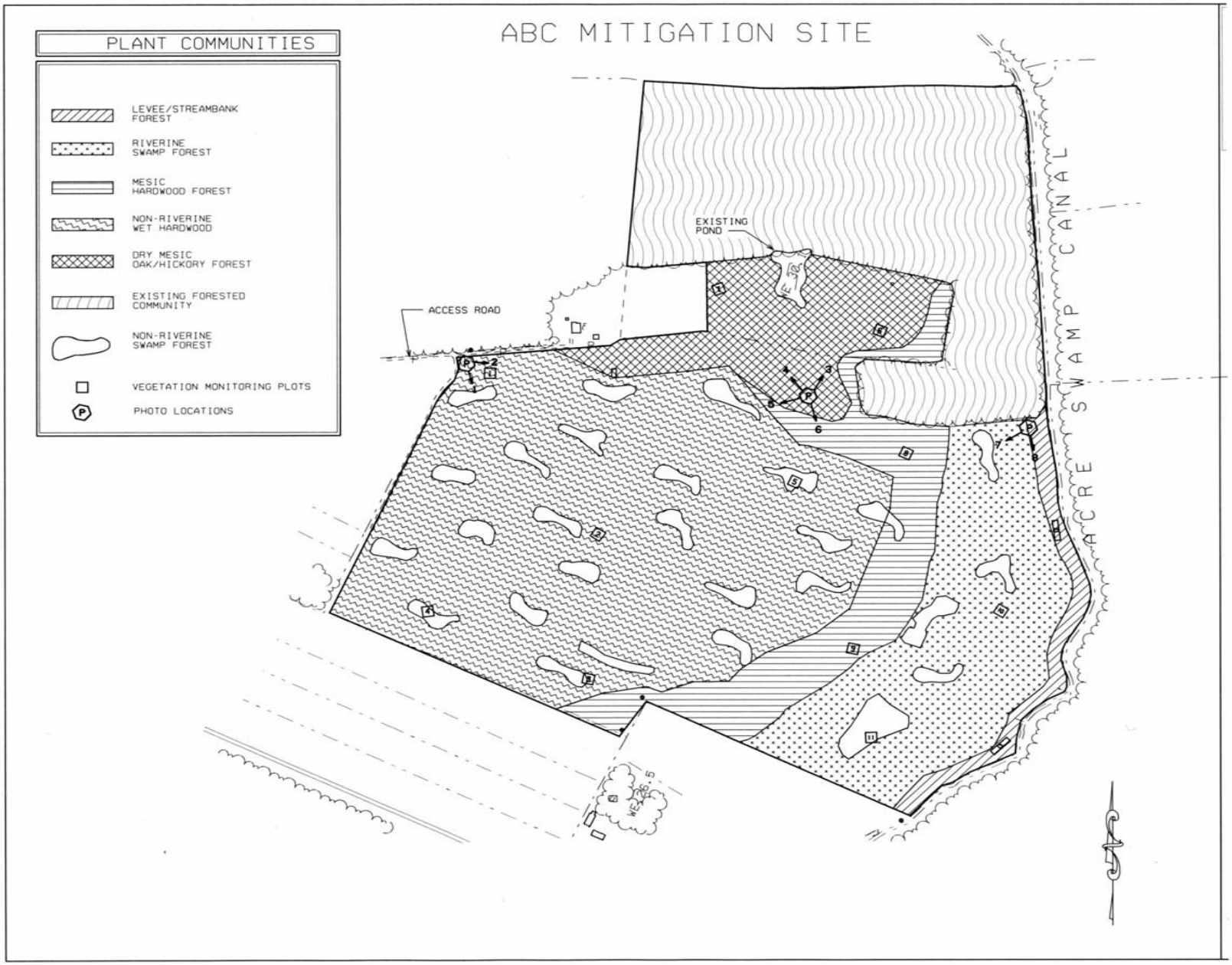
Photo 4

Photo 5

Photo 6

2003

Photo 7

Photo 8

ABC MITIGATION SITE