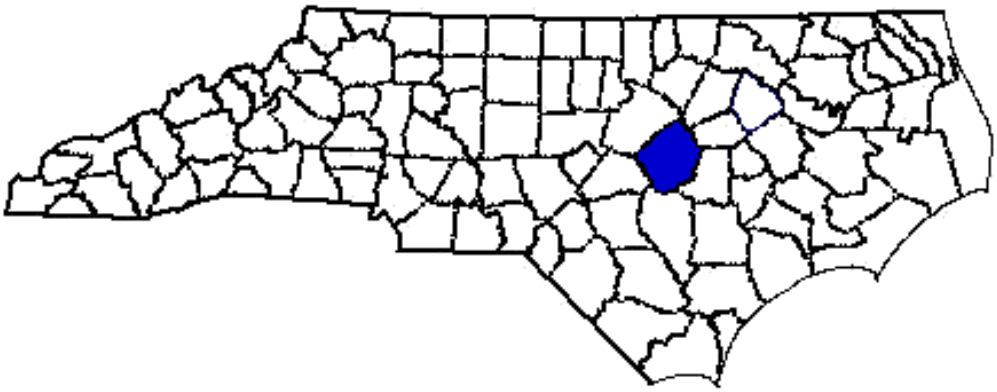
ANNUAL REPORT FOR 2003



Benson Grove Mitigation Site
Johnston County
Project No. 8.1402211
TIP No. R-2547WM

Prepared By:
Office of Natural Environment & Roadside Environmental Unit
North Carolina Department of Transportation
December 2003

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Summary

The following report summarizes the monitoring activities that have occurred in the past year at the Benson Grove Mitigation Site. Site construction was completed in March 2002. The 2003-year represents the second year of monitoring for the site. The site must demonstrate both hydrologic and vegetation success for a minimum of five years or until the site is deemed successful.

Site hydrology is being monitored with eleven groundwater monitoring gauges, three surface water gauges, and one onsite rain gauge. Ten vegetation plots are used to monitor the 31.5 acres planted in trees on the site.

This report utilizes rainfall data from both an onsite rain gauge and a local weather station. The NC State Climate Office provided the historical data for the Smithfield weather station.

All eleven groundwater gauges indicated saturation levels exceeding the 12.5% criterion for the growing season. The three surface gauges showed varying levels of inundation throughout the growing season. Gauge BGSG1 experienced a malfunction and stopped recording data at the end of May, however the gauge did exhibit periods of inundation prior to the malfunction.

Due to low tree counts in 2002, supplemental tree planting was conducted in February 2003. The 2003 vegetation monitoring of the site revealed an average tree density of 581 trees per acre. This average is above the minimum success criteria of 320 trees per acre.

The Roadside Environmental Unit and the Army Corps of Engineers met onsite to evaluate the nuisance tree issue on July 15, 2003. After evaluating the problem it was determined that the nuisance tree issue may need to be addressed in the future.

Based on the monitoring results from the 2003 growing season, NCDOT recommends that monitoring continue on the Benson Grove Mitigation Site.

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

The Benson Grove Site is located just west of NC 50 on SR 1319 (Zacks Mill Rd) in Johnston County. The site is situated in the Neuse River Basin, in the Black Creek Sub-basin. This site mitigates for wetland impacts associated with transportation improvement projects R-2000 (Raleigh Outer Loop), R-2541 (Holly Springs Bypass), and R-2552 (Clayton Bypass).

The site will provide 31.41 acres of SPH/BLH restoration and 50.5 acres of preservation.

1.2 PURPOSE

In order to demonstrate successful mitigation, hydrologic and vegetative monitoring must be conducted for a minimum of five consecutive years. Success criteria are based on federal guidelines for wetland mitigation. These guidelines stipulate criteria for both hydrologic conditions and vegetation survival. The following report details the results of hydrologic and vegetative monitoring during the 2003-growing season at the Benson Grove Mitigation Site.

Activities in 2003 reflect the second year of monitoring following the restoration efforts. Included in this report are analyses of both hydrologic and vegetative monitoring results, as well as local climate conditions throughout the growing season, and site photographs.

1.3 PROJECT HISTORY

December 2001	Herbicide Application I
January 2002	Site Constructed
February 2002	Herbicide Application II
March 2002	Site Planted
June 2002	Vegetation Monitoring (1 yr.)
March – November 2002	Hydrologic Monitoring (1yr.)
February 2003	Site Supplementary Planted
July 2003	Vegetation Monitoring (2 yr.)
July 2003	Onsite agency meeting to discuss nuisance species.
March – November 2003	Hydrologic Monitoring (2yr.)

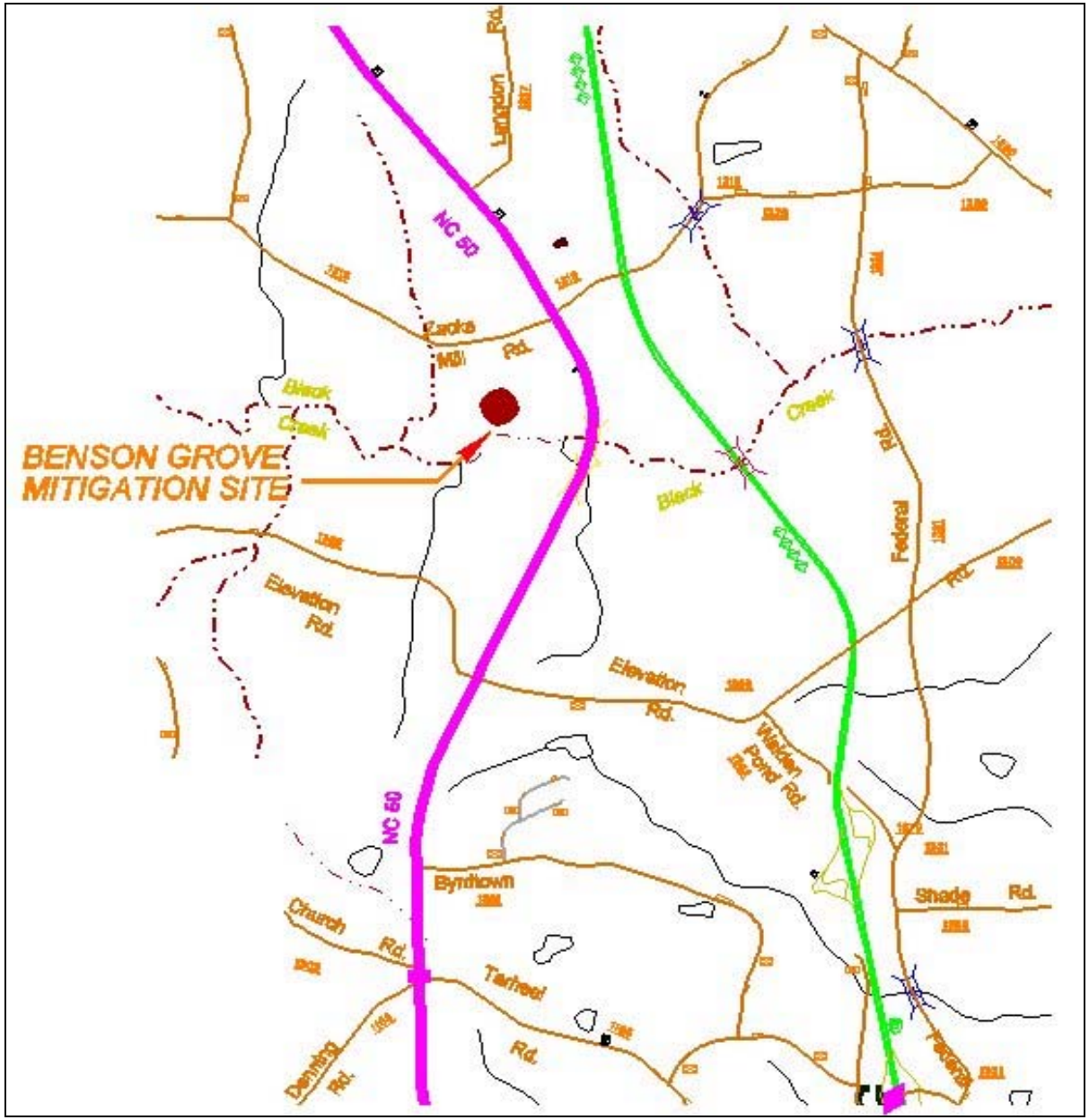


Figure 1. Site Location Map

1.4 DEBIT LEDGER

Table 1. Benson Grove Mitigation Debit Ledger

Site Habitat	Mitigation Plan		TIP Debit	
	Acres at Start	Acres Remaining	R2000F/G R-2547	Remainder Proposed for R2000AB/AC
SPH/BLH Restoration	31.41	0	30.41	1.0
BLH Preservation	50.5	0	50.5	
Totals	81.91	0		

SPH: Swamp Hardwood BLH: Bottomland Hardwood

2.0 HYDROLOGY

2.1 SUCCESS CRITERIA

In accordance with federal guidelines for wetland mitigation, the success criteria for hydrology states that the area must be inundated or saturated (within 12" of the surface) by surface or groundwater for at least a consecutive 12.5% of the growing season during a normal precipitation year.

The growing season in Johnston County begins March 26 and ends November 10. These dates correspond to a 50% probability that temperatures will not drop to 28°F or lower after March 26 and before November 10.[1] The growing season is 229 days; therefore, optimum hydrology requires 12.5% of this season, or at least 29 consecutive days. Local climate must also represent average conditions for the area.

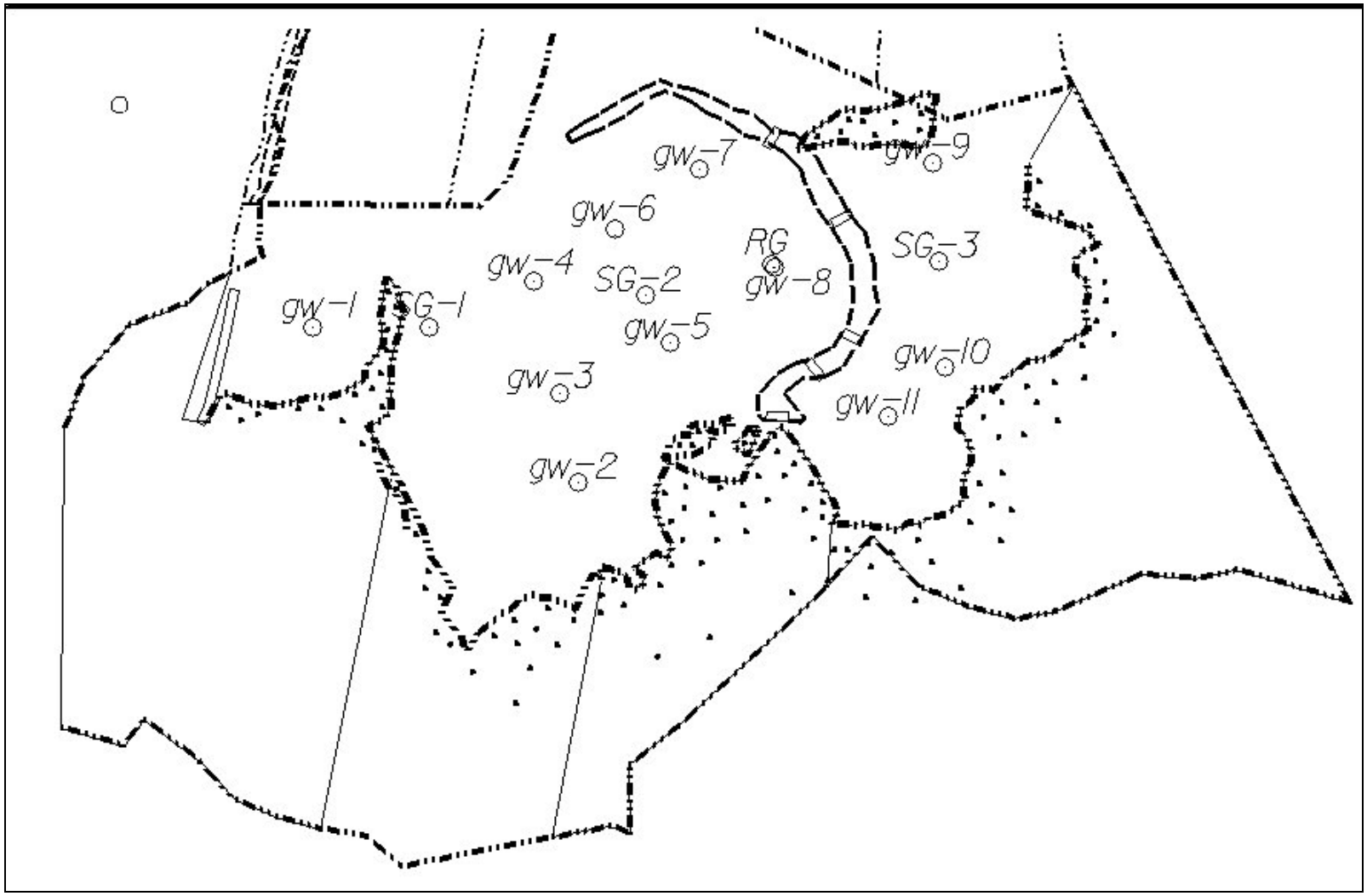
2.2 HYDROLOGIC DESCRIPTION

In March 2002, eleven groundwater gauges, three surface water gauges, and one onsite rain gauge were installed throughout the site (Figure 2). The automatic monitoring gauges record daily readings of groundwater depth. This represents the second full growing season that the monitoring gauges have been in place.

The Benson Grove site was designed to receive hydrologic input from rainfall and surface water accessing the floodplain. The hydrologic monitoring also shows the reaction of the groundwater level to specific rainfall events.

[1] Natural Resources Conservation Service, Soil Survey of Wake County, North Carolina, p. 79.

Figure 2. Monitoring Gauge Location Map



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 well. This number was converted into a percentage of the 229-day growing season (March 26 – November 10). The results are presented in Table 2.

Appendix A contains charts of the groundwater depth for each monitoring gauge during 2003. The maximum number of consecutive days is noted on each graph.

Figure 3 provides a graphical representation of the hydrologic results. Gauges highlighted in blue indicate wetland hydrology for more than 12.5% of the growing season. Gauges highlighted in red show hydrology between 8% and 12.5% of the season, while those in green indicate hydrology between 5% and 8% of the growing season. Gauges highlighted in gray indicate no wetland hydrology (less than 5% of the growing season).

Table 2. **Benson Grove Hydrologic Monitoring Results**

Monitoring Well	<5%	5-8%	8-12.5%	>12.5%	Actual %	Success Dates
BGGW-1+				✕	100	March 26-Nov 10
BGGW-2				✕	47.0	March 26-May 17 May 19-Sept 3
BGGW-3				✕	69.6	March 26-Sept 1
BGGW-4				✕	25.7	March 26-May 13 July 2-Aug 29
BGGW-5				✕	75.7	March 26-Sept 15
BGGW-6+				✕	87.8	March 26-Oct 13
BGGW-7+				✕	100	March 26-Nov 10
BGGW-8				✕	75.7	March 26-Sept 15
BGGW-9+				✕	100	March 26-Nov 10
BGGW-10+				✕	87.8	March 26-Oct 13
BGGW-11+				✕	70.0	March 26-Sept 2 Sept 4-Nov 10

+ Gauge met the success criterion during an average rainfall month (September and October).

Specific Gauge Problems:

- Gauge BGSG1 experienced a malfunction and stopped recording data at the end of May. The gauge was not downloaded for the rest of the growing season.

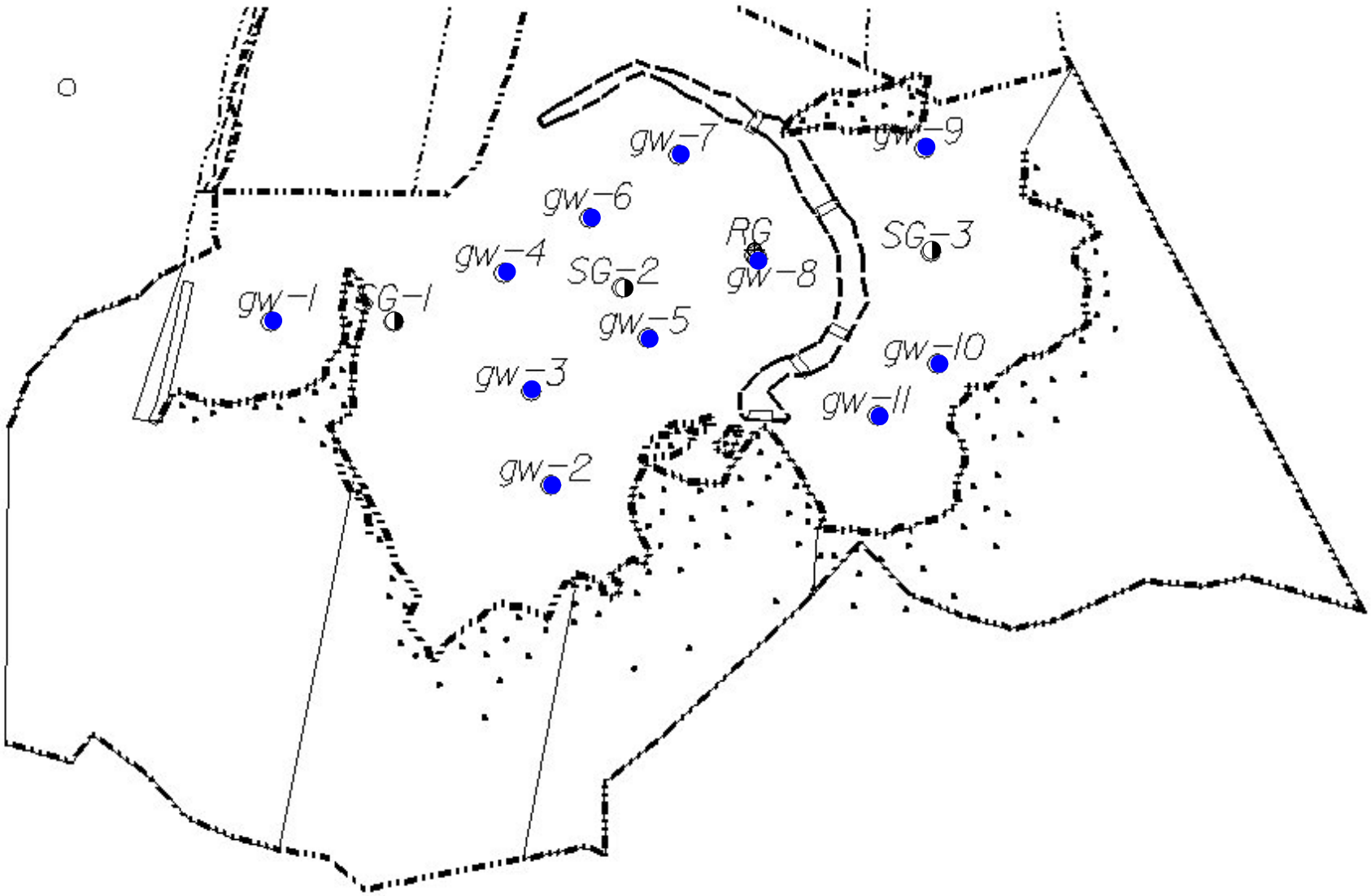


Figure 3. 2003 Hydrologic Monitoring Gauge Results

Hydrology Results

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

Rain Gauge

Surface Gauge

N

Not to Scale

2.3.2 Climatic Data

Figure 4 represents an evaluation of the local climate in comparison with historical data in order to determine whether 2003 was “average” in terms of rainfall. The two lines represent the 30th and 70th percentiles of monthly precipitation for Smithfield. The bars are the monthly rainfall totals for the 2002 and 2003 hydrologic year. The historical data and monthly rainfall was collected by the National Climatic Data Center. The onsite rain gauge for Benson Grove malfunctioned, therefore the rain gauge from the Smithfield weather station was used for July 11 through November 28.

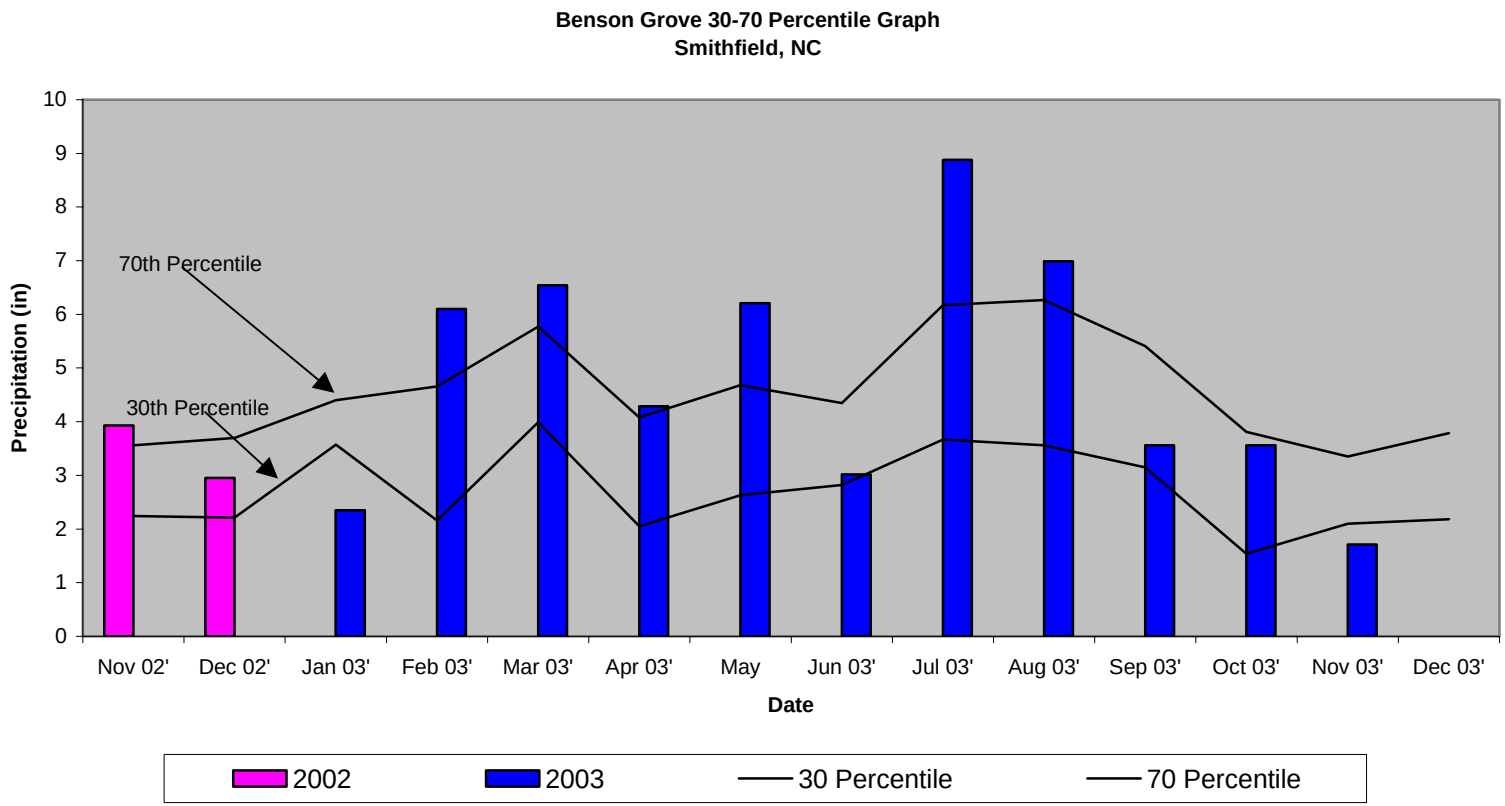
Months with below average rainfall include: January, June, and November. The months of December (02’), September, and October experienced average rainfall. November (02’), February, March, April, May, July, and August experienced above average rainfall. Overall, the site experienced average to above average rainfall in 2003.

2.4 CONCLUSIONS

The 2003-year represents the second year for hydrologic monitoring. All eleven gauges indicated saturation within 12” of the ground for greater than 12.5% of the growing season. The three surface gauges revealed varying levels of inundation throughout the growing season. Gauge BGSG1 experienced a malfunction and stopped recording data at the end of May, however the gauge did exhibit periods of inundation prior to the malfunction.

NCDOT will continue to monitor the Benson Grove Mitigation Site for hydrology.

Figure 4: 30-70 Percentile Graph



3.0 VEGETATION: BENSON GROVE MITIGATION SITE (YEAR 2 MONITORING)

3.1 SUCCESS CRITERIA

Success criteria states 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 desired vegetation has not been established, NCDOT will notify the appropriate agencies and will implement corrective measures.

3.2 DESCRIPTION OF SPECIES

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

Fraxinus pennsylvanica, Green Ash

Quercus falcata var. *pagodaefolia*, Cherrybark Oak

Quercus laurifolia, Laurel Oak

Quercus lyrata, Overcup Oak

Quercus nigra, Water Oak

Liriodendron tulipifera, Tulip Poplar

Quercus phellos, Willow Oak

Taxodium distichum, Baldcypress

Nyssa aquatica, Water Tupelo

3.3 RESULTS OF VEGETATION MONITORING

TABLE 3: Vegetation Monitoring Statistics

Plot #	Green Ash	Cherrybark Oak	Laurel Oak	Overcup Oak	Water Oak	Tulip Poplar	Willow Oak	Baldcypress	Water Tupelo	Total (2 year)	Total (at planting)	Density (Trees/Acre)
1				5	4	1	3	1		14	28	340
2	4	4	2	6	2	1	4			23	23	680
3	5	1	1	1	1		5	1		15	31	329
4	6		1	3			6	7		23	23	680
5	7	4	5	8	1	1	8			34	35	661
6	3	4	2	2	1			9		21	32	446
7	4							12	4	20	20	680
8	1	1	2	9			12	4		29	31	636
9	7	1	1	5			3	27	2	46	46	680
10	12	2	2	10	1		9	3		39	39	680
					Total Density Average							**581**

Site Notes: Other species noted: sweetgum, red maple, *Baccharis halimifolia*, ragweed, thistle, Queen Ann's Lace, broomsedge, morning glory, fennel, and horse-nettle. Red maple and sweet gum were very thick in some areas of the site. Standing water was noted at time of monitoring. Beaver activity was also noted in and around plot 1.

3.4 CONCLUSIONS

Of the 81.9 acres on this site, approximately 31.5 acres involved tree planting. There were ten vegetation-monitoring plots established throughout the planting areas. The 2003 vegetation monitoring of the site revealed an average tree density of 581 trees per acre. This average is above the minimum success criteria of 320 trees per acre. Supplemental planting was performed in February 2003 and the numbers reflect the new planting.

The Roadside Environmental Unit and the Corps of Engineers met onsite to evaluate the nuisance tree issue on July 15, 2003. After evaluating the problem, it was determined that NCDOT will continue to monitor the site and that the nuisance tree issue may need to be addressed in the future.

NCDOT will continue vegetation monitoring on the Benson Grove Mitigation Site.

4.0 OVERALL CONCLUSIONS/RECOMMENDATIONS

For 2003, all eleven groundwater gauges indicated saturation within 12” of the ground for greater than 12.5% of the growing season. The three surface water gauges further indicated periods of inundation on the site. The 2003 vegetation monitoring of the site revealed an average tree density of 581 trees per acre, after supplemental tree planting was completed in February 2003.

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

APPENDIX A

GAUGE DATA GRAPHS

APPENDIX B

SITE PHOTOS & PLANTING PLAN

Benson Grove

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

2003

Photo 7

Photo 8

Photo 9

Photo 10

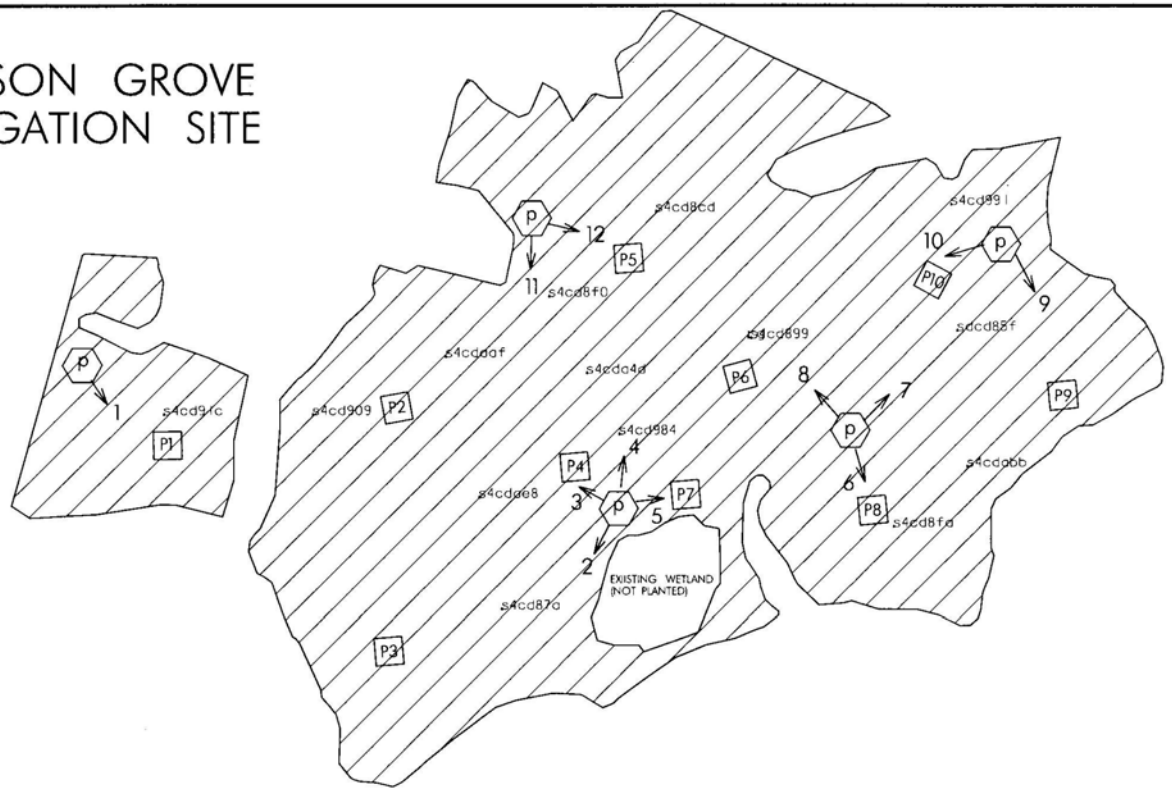
Photo 11

Photo 12

2003

PROJECT REFERENCE NO.	SHEET NO.
R-2541	
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

BENSON GROVE MITIGATION SITE



VEGETATION MONITORING PLOTS

PHOTOGRAPH LOCATIONS