Annual Progress Report on the Neuse Agricultural Rule
(15A NCAC 2B .0238)

A report to the NC Environmental Management Commission
from the Neuse Basin Oversight Committee

November 10, 2005

Summary

The Neuse Basin Oversight Committee (BOC) has received and approved annual reports estimating progress for the 2004 crop year from seventeen Local Advisory Committees (LACs) operating under the Neuse Agricultural Rule as part of the Neuse Basin Nutrient Strategy. For the entire basin, agriculture has achieved an estimated 44% nitrogen reduction compared to the 1991-1995 baseline. This represents an improvement in nitrogen reduction compared to a 42% nitrogen reduction reported for 2003. All of the seventeen LACs have achieved their nitrogen reduction goal established by the BOC. Craven, Franklin, Johnston, Jones, and Wilson counties, have been able to maintain their nitrogen reduction of over 40% reported last year. In addition, Carteret, Durham, Greene, Pitt, and Wake counties were also able to reduce their nitrogen loading from agricultural lands more than 40% in 2004. Nitrogen loading reduction from agricultural land was accomplished through best management practice (BMP) installation, fertilizer application reduction, and cropland conversion to grass, trees, or development. The BOC will continue to focus their efforts on maintaining the reductions that have been achieved and promoting further implementation of conservation practices.

This annual report includes refinements to values reported in each of the last three years. In September 2004, NCSU scientists released a new version of the Nitrogen Loss Evaluation Worksheet (NLEW) software that incorporates the updated Natural Resource Conservation Service (NRCS) electronic soils database and accounts for certain vegetable crops grown in the basin. For this report, all previous years were recalculated using this new version. The revision of NLEW has led to adjustments in both individual LAC and basinwide nitrogen reduction rates for each year previously reported.

Rule History and Requirements

In December 1997, the Environmental Management Commission (EMC) adopted the Neuse River Basin Nutrient Sensitive Waters (NSW) Management Strategy. For the first time in state history, mandatory controls were applied not only on point source pollution but also comprehensively on nonpoint source pollution in the Neuse River basin. The strategy has eight rules that affect both urban and rural areas. The strategy is aimed at reducing the average annual load of nitrogen delivered to the Neuse River Estuary from point and nonpoint source pollution by a minimum of 30% of the average annual load from the period 1991 through 1995 by the year 2003.

The Neuse agricultural rule provides each farmer with the option of becoming part of a collective local strategy for implementing BMPs or implementing standard BMPs as specified in the rule. A Basin Oversight Committee and seventeen Local Advisory Committees were established to implement the Neuse agricultural rule and to assist farmers with complying with the rule.

All seventeen LACs submitted their first annual reports to the BOC in May 2002. All LACs achieved their collective nitrogen reduction goal established by the BOC during 2002, as reported in 2003. This annual report covers progress through calendar year 2004. Nitrogen loss from agricultural land has been reduced by over 40% compared to the baseline numbers for Carteret, Craven, Durham, Franklin, Greene, Johnston, Jones, Pitt, Wake, and Wilson counties. For the basin as a whole, the agricultural community has achieved a 44% nitrogen reduction compared to the overall baseline.

Current Status

Nitrogen Reduction from Baseline for 2004

All seventeen LACs submitted their fourth annual report to the BOC in May 2005. Additional BMPs were planned and implemented in the Neuse River basin in 2004. For the entire basin, agriculture has achieved a 44% nitrogen reduction when using NLEW to compare the 2004 crop year to the 1991-1995 baseline. Most counties reported an increase in nitrogen reduction compared to what was reported last year. All LACs have achieved their individual nitrogen reduction goal established by the BOC. Table 1 lists each county's baseline, its proposed reduction goal, and nitrogen reduction from baseline in 2003 and 2004.

Changes to NLEW Nitrogen Accounting Tool

The essence of NLEW is an empirically derived spreadsheet model that estimates nitrogen export from agricultural management units through surface water and groundwater partitioning of nitrogen movement. The primary use of NLEW is to estimate relative reduction in nitrogen export through a pre- and post-BMP implementation calculation, rather than estimating delivery to surface waters.

In September 2004, NCSU scientists completed a new version of NLEW. This latest version incorporates updated soil series that are now certified by NRCS. This revised NLEW also includes updates to account for vegetable crops such as cucumbers and Irish potatoes. Because these updates showed significant varying effects across counties, it was necessary to regenerate NLEW runs for all previous reporting years including the baseline using the updated version. This "re-calculating" of previous year's data led to changes across all counties and the basin as a whole. Table A-1 of Appendix A, compares results between original and new NLEW runs and provides a description of this process.

Table 1. Summary of County N Loss and its reduction from Baseline in 2003 & 2004*

County	Baseline N Loss* (lbs.)	Proposed Reduction Goal	N Reduction From Baseline in 2003	2004 N Loss* (lbs.)	N Reduction From Baseline in 2004
Carteret	1,590,336	>30%	37.8%	715,239	55.0%
Craven	4,117,771	>30%	57.6%	1,685,712	59.1%
Durham	88,274	>30%	29.4%	51,887	41.2%
Franklin	73,013	30%	47.1%	33,157	54.6%
Granville	71,141	21%	39.1%	47,749	32.9%
Greene	4,826,509	30%	38.4%	2,763,761	42.7%
Johnston	6,365,245	30%	42.5%	3,171,760	50.2%
Jones	2,887,499	>30%	42.8%	1,497,591	48.1%
Lenoir	4,308,849	>30%	41.2%	2,627,535	39.0%
Nash	1,127,424	30%	36.9%	788,872	30.0%
Orange	182,405	18%	42.9%	113,858	37.6%
Pamlico	2,740,111	>30%	39.8%	1,765,418	35.6%
Person	369,037	26%	41.6%	273,407	25.9%
Pitt	3,140,110	30%	38.7%	1,710,096	45.5%
Wake	554,794	30%	36.6%	195,067	64.8%
Wayne	8,113,993	30%	32.3%	5,569,832	31.4%
Wilson	2,037,003	>30%	60.6%	907,902	55.4%
Collectively for the entire Neuse River Basin	42,593,514		41.4%	23,918,843	43.8%

* The total nitrogen loss value is for comparative purposes only. It represents fertilizer that was applied and neither used by crops nor intercepted by BMPs in a Soil Management Unit, based on NLEW calculations. It may not represent the actual loss from the Soil Management Unit.

As shown in Table 2, nitrogen loss reduction from agricultural land was accomplished through BMP installation, better management of fertilizer, and cropland attenuation. Staff estimates that these factors contributed in the following percent reduction:

Table 2. Reasons for Nitrogen Loss from Agriculture Land

	2003	**2004**
BMP Implementation	12%	11%
Fertilization Management	14%	12%
Cropping Shift	4%	5%
Cropland converted to grass/tree	1%	1%
Cropland lost to idle land	7%	10%
Cropland lost to development	4%	5%
TOTAL	42%	44%

BMP Installation

More BMPs have been installed in 2004 due to the increase in federal financial and technical assistance provided in the 2002 Farm Bill, and the continued assistance of the North Carolina Agriculture Cost Share Program (ACSP) and the Conservation Reserve Enhancement Program (CREP). It is estimated that over half of enrolled croplands received treatment from the installed BMPs. BMP installation goals were set by the local nitrogen reduction strategy, which was approved by the EMC in 1999. As shown in Table 3, agriculture has exceeded all of these goals with the exception of nutrient management.

Table 3. Nitrogen-Reducing Best Management Practices Installed in the Neuse River Basin from 1996 to 2004

BMP Types	**BMP Installation Goals (ac)**	**1996-2003 (ac)**	**1996-2004 (ac)**	**2004 Progress (ac)**	**Goal Exceedence as of 2004 (ac)**
20' vegetated buffer	1,100	29,626	30,549	923	29,449
30' vegetated buffer	700	8,866	9,840	974	9,140
20' forested buffer	270	35,126	38,979	3,853	38,709
50' riparian buffer	2000	139,470	141,713	2,243	139,713
Scavenger Crop	5,200	37,074	39,578	2,504	34,378
Nutrient Management	280,000	255,595	263,450	7,855	*-16,550*
Water Control Structure	42,000	52,809	55,812	3,003	13,812

Not all types of BMPs provide nitrogen reduction, however many can provide other water quality benefits. BMPs can reduce loading of sediment and other nutrients, such as phosphorus, from agricultural lands to surface water and shallow groundwater. Table 4 lists these types of BMPs installed from 1996 to 2004, which have prevented the erosion of more than 520 thousand tons of soil. Units of BMPs reported in Table 4 are the actual BMP footprint acreage, as opposed to the acreage treated by the BMPs.

Table 4. Best Management Practices Not Receiving Nitrogen Reduction Credits Installed in the Neuse River Basin from 1996 to 2004

BMP Types	1996-2003*	1996-2004 *	Annual Progress
Conservation Tillage	64,486 acres	68,313acres	3,827 acres
Conservation Tillage 3 Yr.	6,033 acres	7,546 acres	1,514 acres
Long Term No-Till	12,209 acres	13,397acres	1,188 acres
Terraces	12,921 ft	13,657 ft	1,972 ft
Diversion	130,241 ft	130,621 ft	380 ft
Sod Based Rotation	2,038 acres	3,664 acres	1626 acres
Strip Cropping	44 acres	44 acres	0
Field Border	366 footprint acres	501 footprint acres	135 footprint acres
Grassed Waterway	1,369 footprint acres	2,054 footprint acres	685 footprint acres
Livestock Exclusion	29,370 ft	58,209 ft	28,839ft
Streambank Stabilization	100 ft	100 ft	0
Filter Strip	54 foot print acres	54 foot print acres	0

***** Information obtained from NC Agricultural Cost Share Reports 12/1995 through 12/2004. Best Management Practices that were voluntarily installed through various federal programs or without government assistance are not included.

Fertilizer Management

With greater nutrient management and increased costs of fertilizer, farmers in the Neuse River Basin have reduced their fertilizer application since 1996. Table 5 indicates that fertilization rates for most major crops in the basin have been reduced from baseline period. For major crops, LACs reported that farmers in the basin used slightly less fertilizer in 2004 than in 2003.

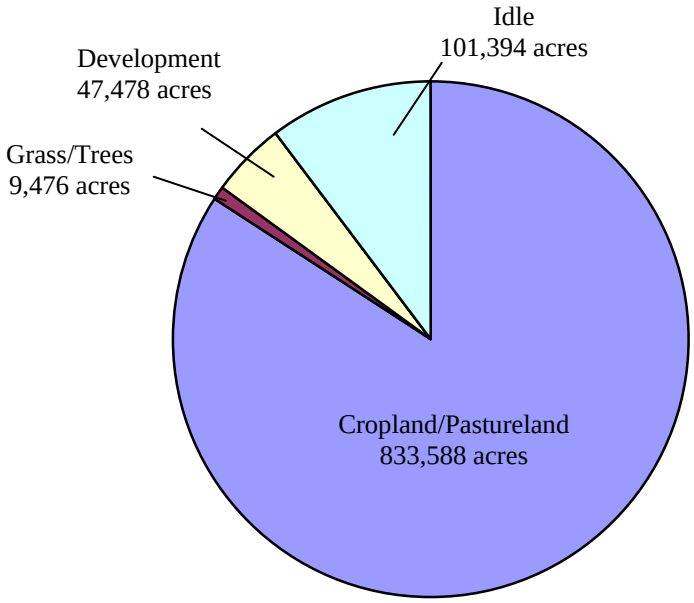
Table 5. Average Fertilization Rate for Major Crops in the Neuse River Basin in 2004 and 2003 Compared to the Baseline Period (1991-1995)

Crop	Baseline Average Fertilization Rate (lbs./acre)	2003 Average Fertilization Rate (lbs./acre)	2004 Average Fertilization Rate (lbs./acre)
Corn for Grain	160	135	132
Corn for Silage	127	138	130
Soybeans	19	4	2
Soybeans – Waste	106	119	119
Cotton	84	74	71
Wheat	112	105	108
Tobacco	87	79	77

Cropland Loss and Cropping Shift

Total acres of cropland in the Neuse River basin fluctuate every year. Each year, some cropland is permanently lost to development or converted to grass or forest land. The Neuse River Basin has experienced significant growth since the 1980s. Durham, Johnston, and Wake Counties are growing the fastest in the upper basin, with Pitt County growing fastest in the lower basin. As shown in Figure 1, approximately 2,783 more acres of basin cropland were lost to development in 2004. Cropland loss has contributed significant nitrogen reductions for Johnston, Wake, and Wayne Counties. Cropland taken out of production only temporarily is reported in the idle land category.

Figure 1. Neuse River Basin - Loss of Agricultural Land to other Land Uses From the Baseline Period (1991-1995) to 2004



The Basin Oversight Committee recognizes the dynamic nature of agricultural business and science resulting from a variety of factors including:

- Changes in world economies or trade policies
- Changes in government programs (i.e., commodity support or environmental regulations)
- Weather (i.e., long periods of drought or rain)
- Scientific advances in agronomics (i.e., production of new types of crops or improvements in crop sustainment)
- Plant disease or pest problems (i.e, viruses or foreign pests)
- Farm location (i.e., large grain grower renting local farms moves to cash crop as rental lands sold to development)
- Age of farmer (i.e., as retirement approaches farmers may move from row crops to cattle)

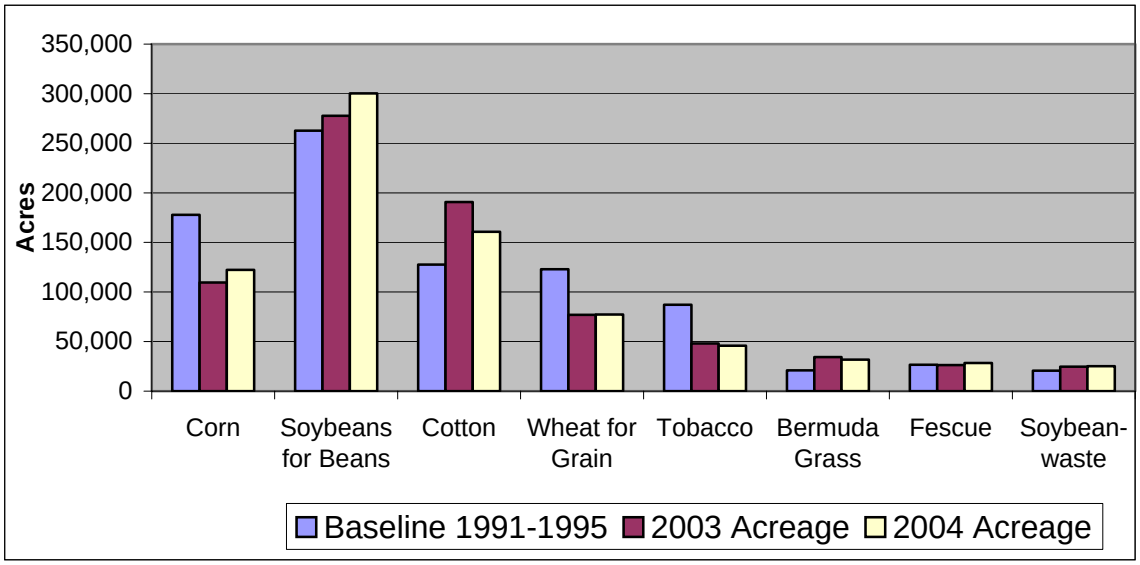
Figure 2 compares crop pattern in the Neuse River basin between the baseline period (1991-1995), 2003 and 2004. It shows that there were increases in acres of corn, soybeans, and fescue. Cotton, tobacco, and bermuda grass acreage decreased. Wheat for grain acreage remained constant. There were more corn and soybean acres in 2004 than 2003, and fewer cotton acres. This appears to contradict the shift from corn to cotton production seen during the 1990's. This change is significant because corn has a considerably higher nitrogen requirement than does cotton. This change in crop production brought about an increase in nitrogen use on agricultural lands in 2004.

It is important to note, however, that nitrogen application rates for corn have dropped significantly relative to the baseline due to intensive nutrient management education efforts and to the increasing cost of nitrogen. This reduction in corn fertilization rates mitigated the effect of a shift back to corn at a certain level. Another important factor is that more BMPs have been installed in 2004 due to the increase of financial and technical assistance provided in the 2002 Farm Bill. As a result, the agricultural community in the Neuse River basin still reported an increase in nitrogen loading reduction in 2004 compared to 2003.

Historical farming practices in North Carolina cannot be used as a reliable predictor for the future agricultural picture in the state. Tobacco and peanut program changes have occurred recently that will likely result in major changes for many farms in the Neuse River Basin. Conversion of cropped lands to other agricultural and non-agricultural uses also remains a likely scenario in many Neuse River Basin counties. New crops are likely to be grown in the basin as a result of bioenergy and biopharmaceutical production. Agriculture in the Neuse River Basin will continue to change over the next decade.

The Local Advisory Committees have been advised of the need to monitor changes in agriculture for the county and to update strategies to accommodate these changes. These changes could result in the need to implement additional best management practices or to redesign or reimplement existing practices based on changes in the practice itself over time, or based on the changes in crops grown, crop management, BMP management or other factors. Individual farm plans must be updated as any changes occur that will result in changes in nitrogen uses on farmlands

Figure 2. Comparison of Crop Pattern in the Neuse River Basin among Baseline Period (1991-1995), 2003, and 2004



Future Steps

Despite significant nitrogen reduction progress observed near the Neuse estuary, the 30% nitrogen reduction target established by the General Assembly has not yet been reached. Nitrogen reduction values presented in this annual summary reflect "edge of field" calculations, which approximate agriculture's contribution to the overall 30% goal. Significant quantities of agricultural BMPs have been installed since initiation of the nutrient management strategy. However, measurable effects from these BMPs on overall instream nitrogen may take years to fully develop due to the nature of nonpoint source water movement. . In the summer of 2005, the Neuse River Basin began a new basinwide planning cycle that included collecting water quality data in the basin. Staffs with the Division of Soil and Water Conservation (DSWC) and Division of Water Quality (DWQ) are currently working with researchers from NCSU to initiate a farmer survey to examine some of the non-structural BMPs, such as nutrient management and cover crop practices.

The Neuse Agricultural Basin Oversight Committee will continue to work with Local Advisory Committees and farmers to reduce nitrogen loss from agricultural lands in the Neuse River Basin. The BOC continues to encourage counties to implement additional BMPs to further reduce nitrogen loss. The Basin Oversight Committee will work closely with the Division of Water Quality throughout the Neuse Basinwide Planning process.

Appendix A: Effects of NLEW Re-Calculations on Previous Annual Reports' Data

In late 2004, NLEW was upgraded with new soils information and vegetable crop data. Each county recalculated their baseline and annual reports. Table A-1 compares the results from the original NLEW program to the results of the updated version, 5.02. Counties such as Franklin and Pitt increased their reductions while others had a slight decrease. However, the most noteworthy aspect of this exercise was that the collective goal for the Neuse River Basin remained the same, 42%.

Table A-1: Comparison of $NLEW_{V5.01}$ and $NLEW_{V5.02}$ Results

County	NLEW V5.01 Baseline (N Loss in lbs.*)	NLEW V5.02 Baseline (N Loss in lbs.*)	NLEW V5.01 Ann Report 04 (N Loss in lbs.*)	NLEW V5.02 Ann Report 04 (N Loss in lbs.*)	NLEW V5.01 Reduction	NLEW V5.02 Reduction
Carteret	1,284,833	1,590,336	687,383	988,458	47%	38%
Craven	3,928,696	4,117,771	1,619,357	1,743,946	59%	58%
Durham	81,542	88,274	57,029	62,349	30%	29%
Franklin	49,688	73,013	32,153	38,631	35%	47%
Granville	60,057	71,141	36,264	43,325	40%	39%
Greene	4,034,046	4,826,509	2,391,588	2,972,455	41%	38%
Johnston	6,094,690	6,365,245	3,159,593	3,663,099	48%	42%
Jones	2,736,562	2,887,499	1,641,904	1,652,875	40%	43%
Lenoir	3,994,989	4,308,849	2,583,554	2,531,680	35%	41%
Nash	872,259	1,127,424	558,983	711,903	36%	37%
Orange	181,276	182,405	85,698	104,120	53%	43%
Pamlico	2,043,961	2,740,111	1,189,828	1,550,793	42%	43%
Person	339,822	369,037	194,588	215,354	43%	42%
Pitt	2,892,783	3,140,110	1,893,113	1,923,616	35%	39%
Wake	557,881	554,794	308,121	351,969	45%	37%
Wayne	7,792,391	8,113,993	5,358,550	5,496,391	31%	32%
Wilson	1,939,073	2,037,003	745,586	803,378	62%	61%
Collective for the entire Neuse Basin	38884549	42593514	22543292	24854342	42%	42%

* The total nitrogen loss value is for comparative purposes only. It represents fertilizer that was applied and neither used by crops nor intercepted by BMPs in a Soil Management Unit, based on NLEW calculations. It may not represent the actual loss from the Soil Management Unit.