Initial Progress Report for the Jordan Lake Agriculture Rule
(15A NCAC 02B.0264)
For the Baseline Period (1997-2001) through Crop Year 2010
A Report to the Water Quality Committee of the NC Environmental Management Commission
From the Jordan Lake Watershed Oversight Committee

SUMMARY

This report provides an initial assessment of collective progress made by the agricultural community to reduce nutrient losses toward compliance with the Jordan Lake Agriculture rule. For this report, the Jordan Lake Watershed Oversight Committee (WOC) implemented the accounting methods approved by the Water Quality Committee in July 2011 to estimate changes in nitrogen loss and the phosphorus loss trend in the three Jordan subwatersheds for the period between the strategy baseline (1997-2001) and the most recent crop year (CY) for which data was available, 2010. This report provides initial progress estimates in three categories: cropland nitrogen, pastureland nitrogen and agricultural phosphorus. To produce this report, Division of Soil and Water Conservation staff received, processed and compiled baseline and current-year reports from agricultural staff in eight counties, and the WOC compiled the information and prepared this report.

The cropland nitrogen portion of the report demonstrates agriculture's collective compliance with the Jordan Agriculture Rule and estimates progress made by agriculture in the watershed to decrease the amount of nutrients lost from agricultural management units. Agriculture has been successfully decreasing nutrient losses in each of the Jordan Lake subwatersheds. In CY2010, all three subwatersheds: Lower New Hope, Upper New Hope and Haw River Subwatersheds are exceeding the rule-mandated reductions for cropland agriculture. In CY2010, agriculture collectively achieved the estimated reductions in nitrogen loss compared to the 1997-2001 baseline, as demonstrated in Table 1. Reductions in nitrogen have been achieved through crop shifts and reduction in nitrogen application rates for the major crops in the watershed. From the baseline to 2010, the watershed has experienced a crop shift from crops with higher nitrogen requirements to mixed cool season grass (hay) and soybeans. In addition, the nitrogen rate on mixed cool season grass (hay) decreased by more than 20 pounds per acre, further reducing nitrogen application in the watershed. Reductions in overall crop acres through land permanently lost from agriculture did not contribute significantly to the nitrogen reductions in the watershed. Refer to Figure 1 for the location of the Jordan Lake Watershed, including the three subwatersheds affected by this rule.

Jordan Lake Watershed Oversight Committee Composition, Jordan Agriculture Rule:

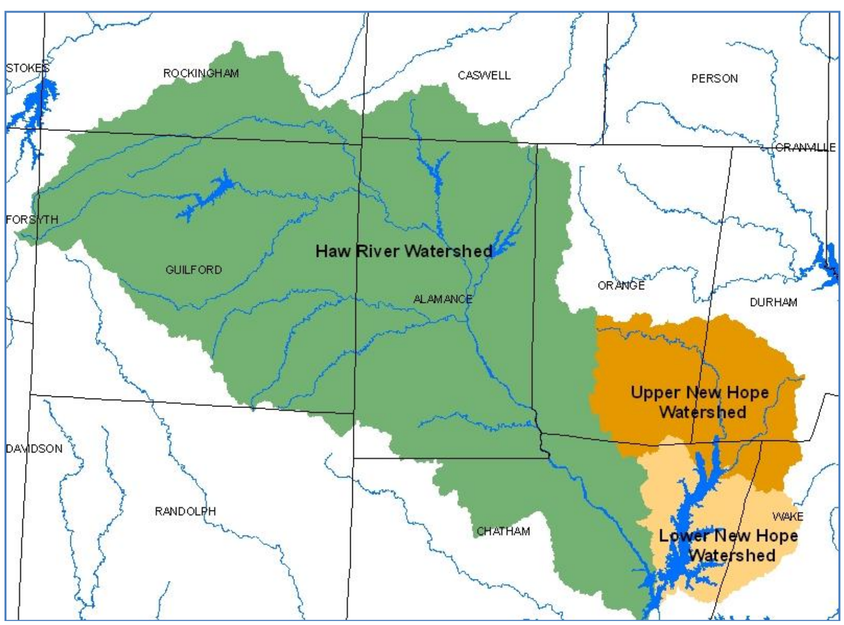
1. NC Division of Soil & Water Conservation
2. USDA-NRCS
3. NCDA&CS
4. NC Cooperative Extension Service
5. NC Division of Water Quality
6. Watershed Environmental Interest
7. Watershed Environmental Interest
8. Environmental Interest
9. General Farming Interest
10. Pasture-based Livestock Interest
11. Equine Livestock Interest
12. Cropland Farming Interest
13. Scientific Community

Qualitative phosphorus indicators demonstrate that there is no increased risk of phosphorus loss, due to the reduction in the acres of tobacco, the decrease in the amount of animal waste phosphorus, and a movement to 90% conservation tillage on cropland in the watershed.

For the initial pastureland point system accounting, in the five years between releases of the Census of Agriculture (2002 and 2007), only the Lower New Hope Subwatershed met its target reduction goal of maintaining the baseline point value of 0, as displayed in Table 2. However pasture management made significant gains in the Haw subwatershed, which comprises 80% of the entire Jordan watershed, achieving 5 points of its aggregate 8-point target. The WOC will revisit pasture progress in the annual report following the 2014 Census of Agriculture, and will offer any rule compliance recommendations called for by the rule to the Water Quality Committee at that time. While this system was developed for the Tar-Pamlico River Basin, Jordan Lake is the first watershed to employ the pastureland point system accounting method. Several factors may affect why the pasture points are low in the Jordan Lake Watershed, the greatest being the amount of agricultural land that is already buffered in the watershed. According to a report completed in 2007, *Delineating Agriculture in the Lake Jordan River Basin,* the majority of agricultural land is already buffered. This study found that, six of the counties had more than 75% of their agricultural land buffered, and that the average buffer width was greater than 50 feet.[1] Land that is already buffered is not captured in the baseline or 2007 reports, as the pasture points system only measures best management practices (BMPs) installed and the affected acres of pasture associated with those practices. Cattle is the predominant pasture animal in the watershed, and the recommended stocking rate is 1.5 acres per cow. While the stocking rate increased from 2002 to 2007, as an aggregate the livestock density is close to the appropriate rate in each subwatershed.

The Jordan Agriculture rule stipulates that if this initial accounting finds that a cropland nitrogen goal has not been achieved in a subwatershed, then Local Advisory Committees shall be formed in that subwatershed and farmers shall register their operations with these committees. Based on the success in nitrogen reductions relative to the strategy goals estimated in this report, the WOC finds that such actions are not required at this time.

Figure 1. Jordan Lake Watershed map



[1] Osmond, Deanna L. 2007. Final Report for the Sampling Analysis: Delineating Agriculture in the Lake Jordan River Basin. Department of Soil Science, North Carolina State University, Raleigh, NC 27606.

Table 1. Summary of estimated reductions in agricultural nitrogen loss (cropland) from baseline (1997-2001) for CY2010, Jordan Lake Watershed

Subwatershed	Required nutrient reductions	2010 nitrogen loss reductions from cropland
Lower New Hope	No increase in nitrogen or phosphorus	50%
Upper New Hope	35% nitrogen, 5% phosphorus	48%
Haw	8% nitrogen, 5% phosphorus	33%

Table 2. Summary of estimated reductions in agricultural nitrogen loss (pastureland) from baseline (2002) to 2007, Jordan Lake Watershed

Subwatershed	Required nitrogen reductions	2007 nitrogen point reductions from pastureland
Lower New Hope	No increase in nitrogen (0 points)	0 points
Upper New Hope	35% nitrogen (35 points)	0.3 points
Haw	8% nitrogen (8 points)	5.0 points

BACKGROUND

Rule requirements and compliance

Effective August 2008, the Agriculture Rule that is part of the Jordan Water Supply Nutrient Strategy provides for a collective strategy for farmers to meet nitrogen loss reduction goals within six to nine years. The goals for this nutrient strategy are specified at the subwatershed level in Table 1, and are compared to the 1997-2001 baseline period. The Lower New Hope Subwatershed has a goal of no increase in nitrogen or phosphorus. The Upper New Hope Subwatershed has a goal of 35% nitrogen loss reduction and 5% phosphorus reduction. The Haw River Subwatershed has a goal of 8% nitrogen loss reduction and 5% phosphorus reduction. A Watershed Oversight Committee (WOC) was established to implement the rule and to assist farmers with complying with the rule.

Jordan NSW Strategy:

The Environmental Management Commission (EMC) adopted the Jordan Water Supply Nutrient Strategy in 2008. The strategy goal is to reduce the average annual load of nitrogen and phosphorus from each of its subwatersheds to Jordan Lake from 1997-2001 baseline levels. In addition to point source rules, mandatory controls were applied to addressing non-point source pollution in agriculture, nutrient management, riparian buffer protection, and urban stormwater. The management strategy built upon the Neuse and Tar-Pamlico River Basins efforts.

All counties submitted their first annual report to the WOC in August 2012. Collectively, all three subwatersheds are meeting their nitrogen loss reductions, with the Lower New Hope Watershed reporting a 50% reduction, the Upper New Hope Watershed a 48% reduction, and the Haw River Watershed with a 33% reduction.

Scope of Report and Methodology

The estimates provided in this report represent whole-county scale calculations of nitrogen loss from cropland agriculture in the watershed made by soil and water conservation district technicians using the 'aggregate' version of the Nitrogen Loss Estimation Worksheet, or NLEW. The NLEW is an accounting tool developed to meet the specifications of the Neuse Rule and approved by the Water Quality Committee of the Environmental Management Commission (EMC) for use in the Jordan Lake Watershed. The development team included interagency technical representatives of the NC Division of Water Quality (DWQ), NC Division of Soil and Water Conservation (DSWC), USDA-NRCS and was led by NC State University Soil Science Department faculty. The NLEW captures application of both inorganic and animal waste sources of fertilizer to cropland. It does not capture the effects of managed livestock on nitrogen applied to pastureland. The NLEW is an "edge-of-management unit" accounting tool; it estimates changes in nitrogen loss from croplands, but does not estimate changes in nitrogen loading to surface waters. Assessment methods were developed and approved by the Water Quality Committee of the EMC for pastureland and phosphorus, and are described later in the report.

NITROGEN LOSS ACCOUNTING

Nitrogen Reduction from Cropland from Baseline for CY2010

All counties submitted their first progress report to the WOC in August 2012. For the Lower New Hope Watershed, through CY2010 agriculture achieved a 50% reduction in nitrogen loss compared to the average 1997-2001 baseline. All of the counties achieved the no net increase reduction goal for nitrogen in this subwatershed individually. For the Upper New Hope Watershed, through CY2010 agriculture achieved a 48% reduction in nitrogen loss compared to the average 1997-2001 baseline. One of the counties did not achieve the at least 35% nitrogen loss reduction goal individually, Orange County. For the Haw Watershed, through CY2010 agriculture achieved a 33% reduction in nitrogen loss compared to the average 1997-2001 baseline. All of the counties achieved the at-least 8% nitrogen loss reduction goal individually. Table 3 lists each county's baseline and CY2010 nitrogen (lbs/yr) loss values from cropland, along with nitrogen loss percent reductions from the baseline in CY2010.

Table 3. Estimated reductions in agricultural nitrogen loss (cropland) from baseline (1997-2001) through CY2010, Jordan Lake Watershed

County	Baseline N Loss (lb)* NLEW	CY2010 N Loss (lb)* NLEW	N Loss Reduction (%) NLEW
Lower New Hope Subwatershed			
Chatham	57,853	33,829	42%
Wake	38,272	14,433	62%
Total	**96,125**	**48,262**	**50%**
Upper New Hope Subwatershed			
Chatham	43,826	22,807	48%
Durham	39,043	11,726	70%
Orange	64,594	44,310	31%
Wake	9,649	3,624	62%
Total	**157,112**	**82,467**	**48%**
Haw Subwatershed			
Alamance	697,924	536,075	23%
Caswell	131,875	88,205	33%
Chatham	220,152	172,210	22%
Guilford	1,393,207	829,290	40%
Orange	235,230	152,648	35%
Rockingham	169,080	134,752	20%
Total	**2,847,468**	**1,913,180**	**33%**

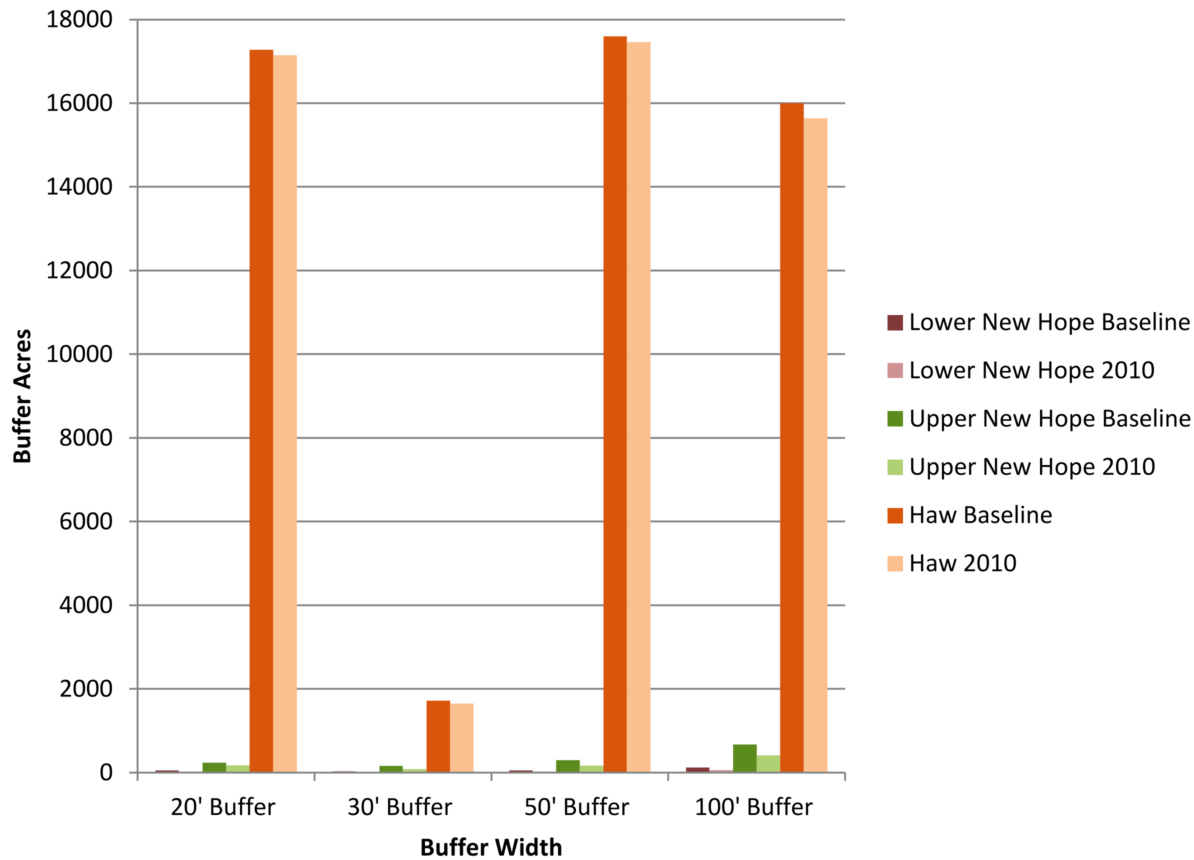
**Nitrogen loss values are for comparative purposes. They represent nitrogen that was applied to cropland in the watershed and neither used by crops nor intercepted by BMPs in a Soil Management Unit, based on NLEW calculations. This is not an in-stream loading value.*

Best Management Practice Implementation

Figure 2 illustrates the amount of buffers on cropland in the Lower New Hope, Upper New Hope and Haw River Subwatersheds in the baseline (1998) and 2010. Riparian buffers have many important functions beyond being effective in reducing nitrogen. Recent research has shown that upwards of 75% of sediment from agricultural sources is from stream banks and that riparian buffers, particularly trees, are important for reducing this sediment. In addition, riparian buffers can reduce phosphorus and sediment as it moves through the buffer and provide other critically important functions.

Agriculture is credited with different nitrogen reduction efficiencies, expressed as percentages, for riparian buffer widths ranging from 20 feet to 100 feet. The NLEW version 6.01 for Jordan Lake provides the following percent nitrogen reduction efficiencies for buffer widths on cropland: 20' receives 20% reduction, 30' receives 25% reduction, 50' receives 30%, and 100' receives 35% reduction. Note that these percentages represent the net or relative percent improvement in N removal resulting from riparian buffer implementation.

Figure 2. Nitrogen Reducing BMPs installed on Croplands from Baseline (1997-2001) and 2010, Jordan Lake Watershed*



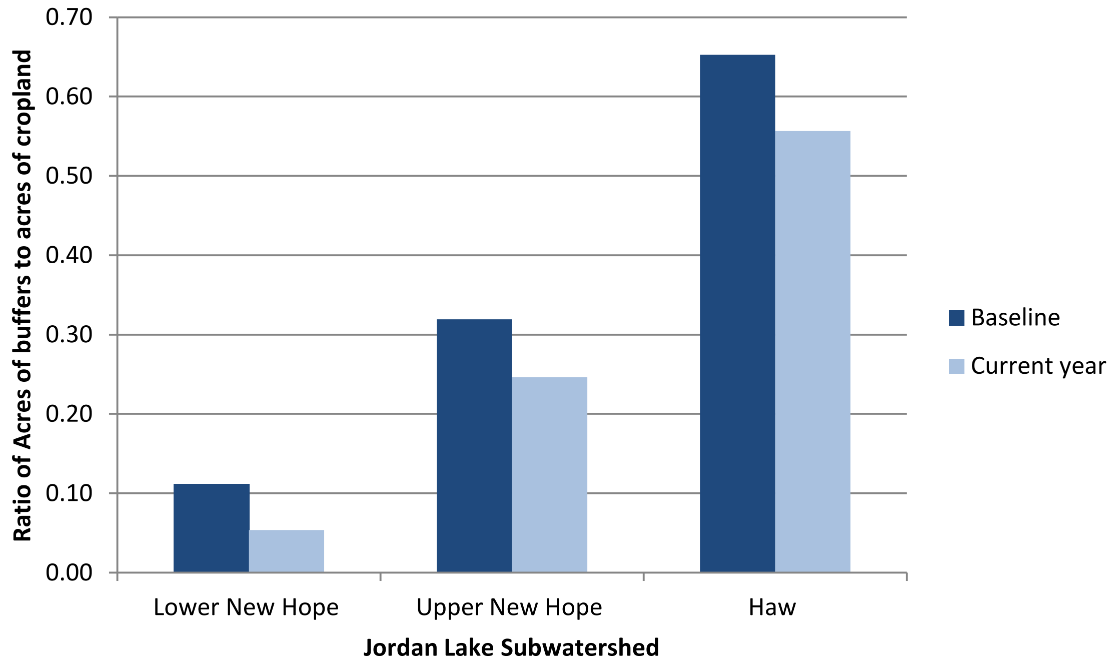
* The acres of buffers listed represent estimated acres from GIS analysis from 1998 and 2010 aerial photography. Cropland acres affected by the buffer could be 5 to 10 times larger than the acreage shown above.[2]

The acreage of riparian buffers on cropland among the different widths for which agriculture receives reductions was obtained from GIS analysis of 1998 and 2010 aerial photography. Overall, total acres of buffers have slightly decreased since the baseline. It is important to note that in the Lower New Hope and Upper New Hope Subwatersheds, this is due to the decrease in the amount of cropland from 1998-2010. In the Lower New Hope Subwatershed, 144 acres or 57% of the buffers in the subwatershed are still there but are no longer eligible for accounting under the agriculture rule. This correlates with the reduction of 12% of cropland with wide riparian buffers in this subwatershed. In the Upper New Hope Subwatershed, 531 acres or 39% of the buffers in the subwatershed are still there but are no longer eligible for accounting under the agriculture rule. This correlates with the reduction of 21% of cropland in this subwatershed. For these two watersheds, the small size of cropland acres greatly increases the effect of any change in agricultural operations or in land use. In the Haw River Watershed the decrease is only 1% of the buffers in the

[2] Bruton, Jeffrey Griffin. 2004. Headwater Catchments: Estimating Surface Drainage Extent Across North Carolina and Correlations Between Landuse, Near Stream, and Water Quality Indicators in the Piedmont Physiographic Region. Ph.D. Dissertation. Department of Forestry and Environmental Resources, North Carolina State University, Raleigh, NC 27606.

watershed and may be attributed to the increase in cropland acres since the baseline period and the effect of GIS analysis and differences between the aerial photography of the different years. Detailed information regarding buffer acreages by subwatershed is displayed in Figures 2 and 3. Figure 2 shows the buffer acres by width in each subwatershed, while Figure 3 shows the ratio of buffer acreage to cropland acreage.

Figure 3. Acres of buffers compared to acres of cropland from Baseline (1997-2001) and 2010, Jordan Lake Watershed



A significant amount of buffers have been installed in the Jordan Lake Watershed through the Ecosystem Enhancement Program (EEP) since the baseline. EEP has completed 51 projects in the watershed from the baseline through 2010. Project data is not tracked regarding previous land use nor the area of buffer restored in conjunction with stream restoration projects. Because EEP funded these buffers for purposes of compensatory mitigation for stream or buffer permitted losses also occurring in the watershed, they are not eligible to be counted for reductions under the agriculture rule, even if they are located on agricultural lands. Thus EEP buffer restoration projects are not included in the totals provided in this report.

Fertilization Management

In this watershed, the majority of crops are under fertilized. Mixed cool season grass (hay) has always been under fertilized in the Jordan Lake Watershed, and continues to be under fertilized. This is important to note as it is the largest acreage crop grown in all three subwatersheds. For many of the high acreage crops, farmers have reduced their nitrogen application from baseline levels, while fertilization rates on other crops others have increased or remained the same. Figure 4 displays the nitrogen application rates in pounds per acre for the major crops in the watershed. Nitrogen application rates for mixed cool season grass (hay) decreased in all subwatersheds by over 20 pounds/acre. Nitrogen application rates for soybeans decreased in two of the subwatersheds, and remained at zero in the Lower New Hope Subwatershed. Farmers applied

> **Factors contributing to changing nitrogen rates:**
>
> - Rising fertilizer costs and fluctuating farm incomes.
> - Mandatory waste management plans.
> - The federal government tobacco quota buy-out reducing tobacco acreage.

more nitrogen in 2010 than in the baseline on corn acres due to differences in crop varieties and increased plant population densities, with expected increases in nitrogen uptake that produce higher yields. Tobacco and wheat experienced increases in nitrogen application rates due to increases in application rates in Wake County in the Lower New Hope Subwatershed, while decreased rates were applied in the subwatersheds with larger acreages. Tobacco companies buying flue-cured tobacco are now stressing higher quality which in many cases leads to reductions in nitrogen applications.

Figure 5 depicts the total annual nitrogen fertilizer applied (pounds) for agricultural crops for the baseline (1997-2001) and 2010 to show the impact of fertilization rates related the crops that are grown. Due to the small size of the subwatersheds in Jordan Lake, minor changes in fertilizer application rates result in significant effects on the reported nutrient reductions on cropland for each subwatershed. Fertilizer rates will be revisited annually by counties using data from farmers, commercial applicators and state and federal agencies' professional estimates.

Figure 4. Average annual nitrogen fertilization rate (lb/ac) for agricultural crops for the baseline (1997-2001) and 2010, Jordan Lake Watershed

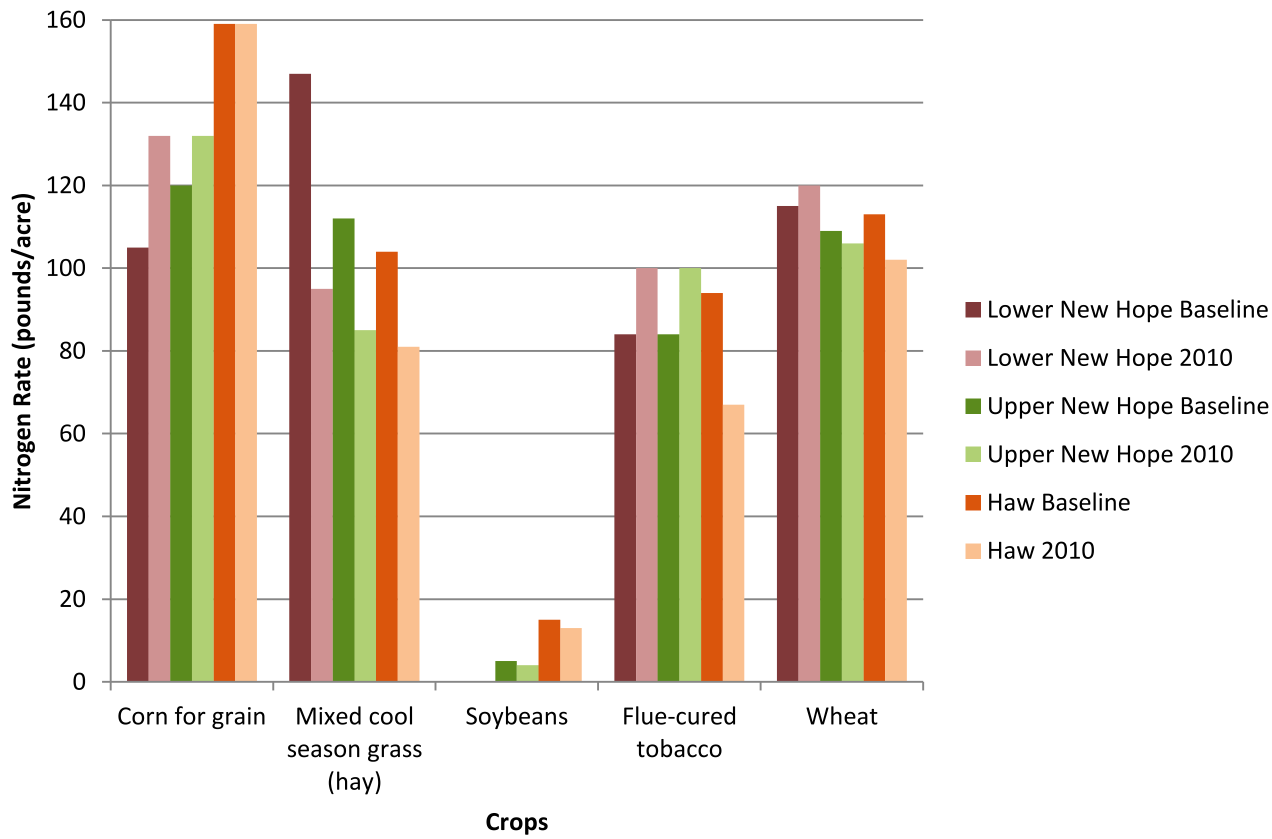
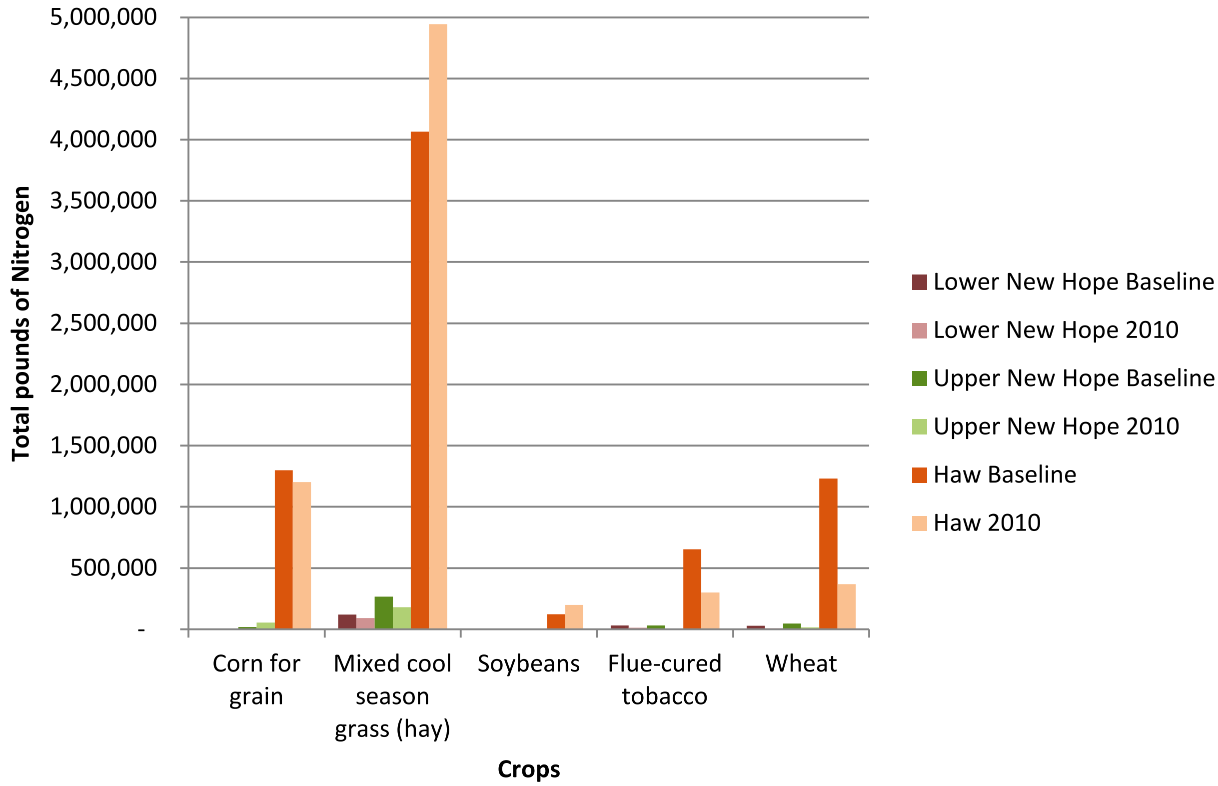


Figure 5. Total annual nitrogen fertilizer applied (lbs) for agricultural crops for the baseline (1997-2001) and 2010, Jordan Lake Watershed

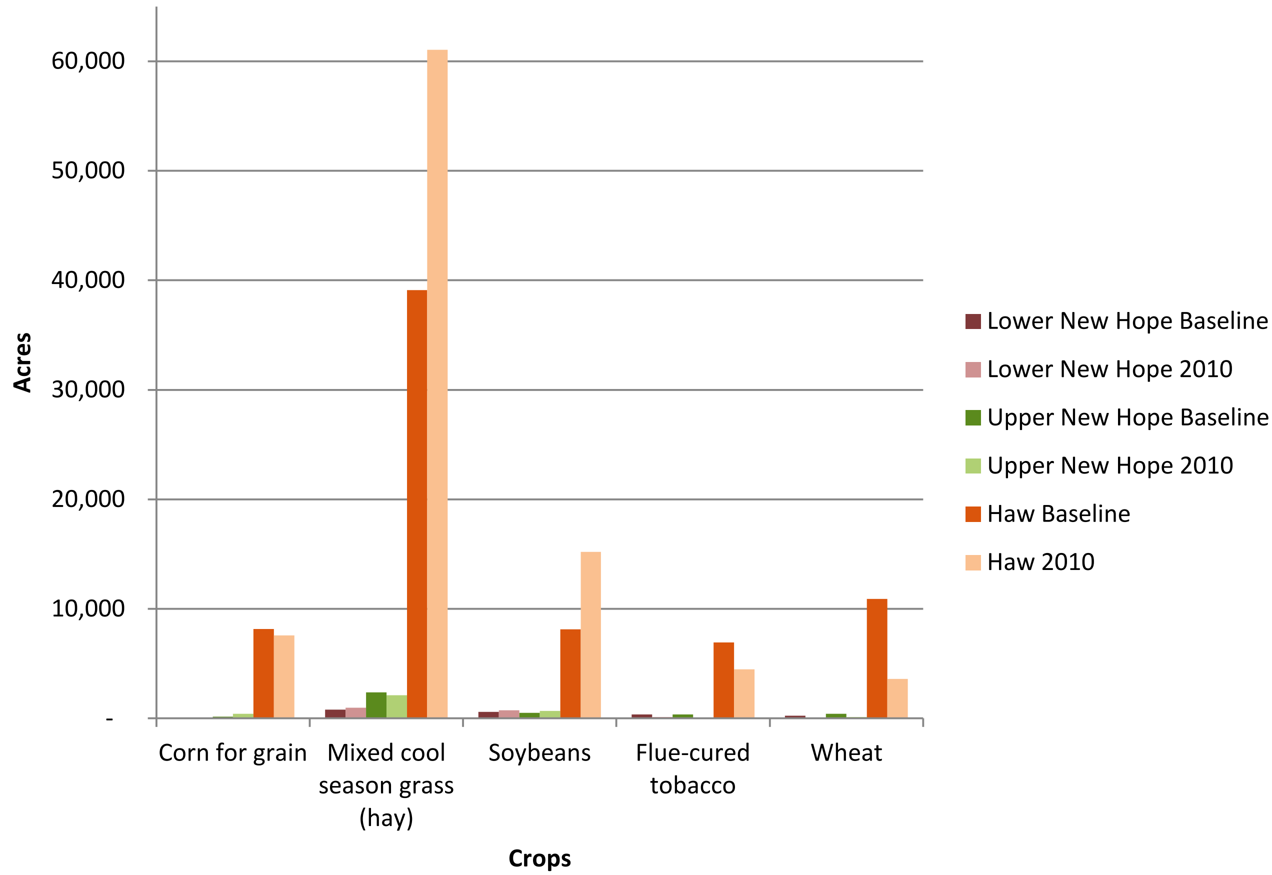


Cropping Shifts

Counties calculated cropland acreage by utilizing crop data reported through the North Carolina Agricultural Statistics Service of the US Department of Agriculture in cooperation with the North Carolina Department of Agriculture and Consumer Services. Each crop requires different amounts of nitrogen and uses the nitrogen applied with different efficiency rates. Changes in the mix of crops grown can have a significant impact on the cumulative yearly nitrogen loss reduction.

Figure 6 shows crop acres and shifts for 2010 compared to the baseline. The acres of mixed cool season grass (hay) increased substantially since the baseline, by over 21,000 acres in the watershed. This shift to hay production may be due to the tobacco quota buyout program, transition from field crops to pasture operations and increased reporting of hayland by farmers. Soybean acreage has also grown by over 7,300 acres across the watershed. Corn production has remained relatively constant, while tobacco and wheat production has decreased by over 3,000 and 7,700 acres respectively. A host of factors from individual to global determine crop choices. Crop acreages are expected to fluctuate with the market yearly.

Figure 6. Acreage of Major Crops for the Baseline (1997-2001) and 2010, Jordan Lake Watershed

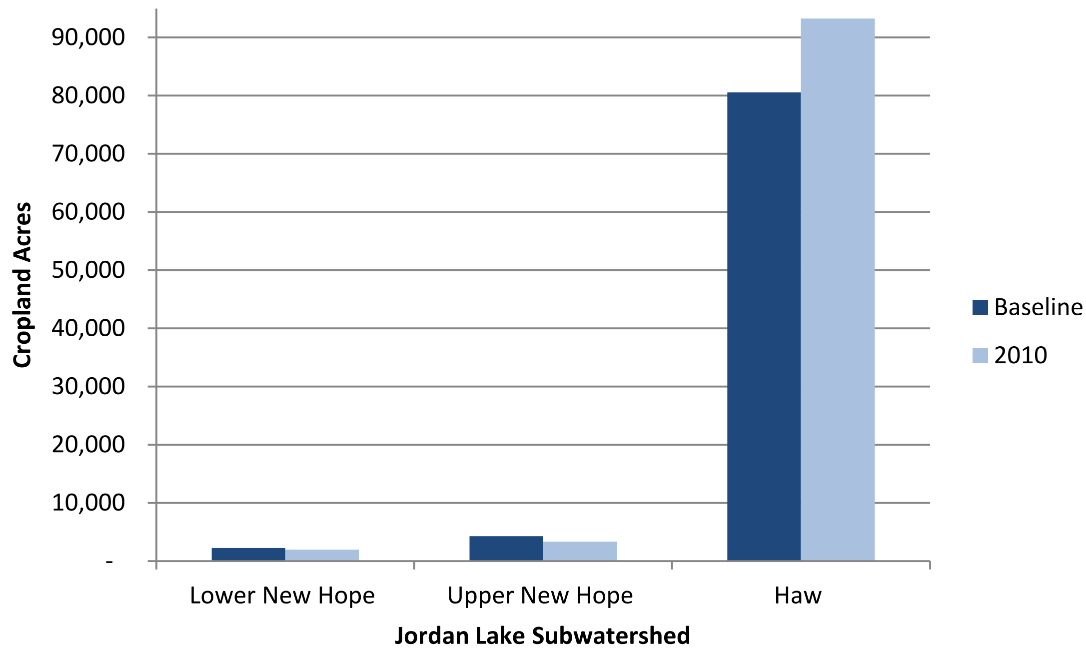


Land Use Change to Development and Cropland Conversion

The number of cropland acres fluctuates every year in the Jordan Lake Watershed and its subwatersheds due to cropland conversion and development. Each year, some cropland is permanently lost to development, or converted to grass or trees and likely to be ultimately lost from agricultural production. Figure 7 displays the total cropland acres in the watershed in the baseline and 2010. Data regarding land use change since the baseline is summarized below by subwatershed.

In the Lower New Hope Subwatershed it is estimated that approximately 1,778 agricultural acres have been permanently lost to development and more than 46 cropland acres have been converted to grass or trees. In the Upper New Hope Subwatershed it is estimated that approximately 3,025 agricultural acres have been permanently lost to development and no cropland acres have been converted to grass or trees through state or federal cost share programs. In the Haw Subwatershed it is estimated that approximately 10,054 agricultural acres have been permanently lost to development and more than 1,774 cropland acres have been converted to grass or trees. These estimates come from methodologies developed at the county level based on available information and reporting requirements associated with development. Each county uses a different method, but these methods are documented and use the best local information available. These estimates do not separate the amount of cropland versus pastureland lost; the number reported is agricultural land converted to development.

Figure 7. Total Cropland Acres in the Jordan Lake Watershed, Baseline (1997-2001) and 2010



Nutrient Management Training

As required by the fertilizer management rule (.0272), nutrient management training was conducted in the Jordan Lake Watershed. NC Cooperative Extension held 26 nutrient management training sessions, and since rule adoption approximately 1,000 farmers and applicators have received training. Training in this watershed is also available online, and to date 116 participants have successfully passed the exam at the end of the course. This online training can be accessed at http://go.ncsu.edu/JordanLakeTraining.

PASTURE POINTS ACCOUNTING

The WOC formed a pasture point system subcommittee in 2010 to revisit the accounting method developed as mandated by a Session Law of the NC General Assembly for the Tar-Pamlico Basin Agriculture Rule. The subcommittee consisted of individuals representing North Carolina State University (NCSU), United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), NC Division of Soil and Water Conservation (DSWC), NC Division of Water Quality (DWQ), NC Department of Agriculture and Consumer Services (NCDA&CS), and Alamance Soil and Water Conservation District. After reviewing available data sources and existing research findings the subcommittee made certain observations and recommendations, which the WOC has accepted.

The pasture point subcommittee found that:

- While the Tar-Pamlico point system was of sound design, it was not practically implementable because it required field-scale assessment, for which human resources were not available. For the purposes of this rule, given the same resources limitations, a county-scale approach to nitrogen loss accounting will be necessary as is done with cropland NLEW accounting.
- Unlike state-based cropland statistics that are developed annually, pasture activities are tracked only by the federal Census of Agriculture conducted by USDA-National Agricultural Statistical Service every five years. This will necessarily limit pasture accounting under this rule to a 5-year cycle. For Jordan Lake accounting, the baseline will be 2002 compared to 2007.

• The point system developed for the Tar-Pamlico is fundamentally sound. It assigned nitrogen "point" credit values for BMPs in lieu of percent reductions based on recognition that research data are insufficient to provide the level of confidence required for attributing percent reductions in nitrogen at the edge of the management unit. Point values reflect best estimates of percent reduction but instead bear the "point" label to connote this greater uncertainty. Research has advanced since the Tar-Pamlico system was developed but not sufficiently to depart from this approach.

As part of the pasture points system, the following data was used for calculation purposes: acres of pastureland, number of pastured animal units, and livestock densities (animal units per acre). Pasture animals included in this analysis include: cattle, equine, and goats. This information was analyzed using the 2002 and 2007 Census of Agriculture, and is presented in Table 4 at the subwatershed level. The percent of each county in each subwatershed, determined by GIS analysis, was used to calculate pasture data for each subwatershed in Jordan Lake.

Cattle is the predominant pasture animal in the watershed, and the recommended stocking rate is 1 cow per 1.5 acres, for a livestock density of 0.67. While the livestock stocking rate increased from 2002 to 2007, as an aggregate the livestock density is close to the appropriate rate in each subwatershed.

Table 4. Pasture and animal unit data by subwatershed in the Jordan Lake Watershed, 2002 and 2007

	2002 Pasture (acres)/sub-watershed	**2002 Animal units/sub-watershed**	**2002 Sub-watershed livestock density (animal units/acre)**	**2007 Pasture (acres)/sub-watershed**	**2007 Animal units/sub-watershed**	**2007 Sub-watershed livestock density (animal units/acre)**
Lower New Hope Subwatershed						
Chatham	5,263.20	3,594.15	0.68	4,731.50	3,455.88	0.73
Wake	1,055.55	492.57	0.47	777.75	423.33	0.54
Total	**6,318.75**	**4,086.72**	**0.65**	**5,509.25**	**3,879.21**	**0.70**
Upper New Hope Subwatershed						
Chatham	2,631.60	1,797.08	0.68	2,365.75	1,727.94	0.73
Durham	1,890.27	1,290.34	0.68	2,020.68	1,116.55	0.55
Orange	5,283.84	3,478.14	0.66	4,665.60	3,797.76	0.81
Wake	422.22	197.03	0.47	311.10	169.33	0.54
Total	**10,227.93**	**6,762.58**	**0.66**	**9,363.13**	**6,811.58**	**0.73**
Haw Subwatershed						
Alamance	30,209.48	17,325.75	0.57	28,800.24	21,276.56	0.74
Caswell	2,821.50	951.76	0.34	2,368.50	1,072.69	0.45
Chatham	12,631.68	8,625.96	0.68	11,355.60	8,294.10	0.73
Guilford	25,775.25	13,711.65	0.53	20,490.00	12,431.34	0.61
Orange	5,504.00	3,623.07	0.66	4,860.00	3,956.01	0.81
Rockingham	6,105.65	2,319.90	0.38	4,487.61	2,298.40	0.51
Total	**83,047.56**	**46,558.09**	**0.56**	**72,361.95**	**49,329.10**	**0.68**

In the five years between releases of the Census of Agriculture, pasture acreage has decreased over 12,300 acres in the watershed, and decreases were experienced in each subwatershed as displayed in Figure 8. Due to the decrease in pasture acreage, and an increase of 2,600 pastured animal units, the livestock density increased from 2002 to 2007. Livestock stocking density is depicted in Figure 9 as measured in animal units per acre.

Figure 8. Pasture acreage in the Jordan Lake Watershed, Baseline (2002) and 2007

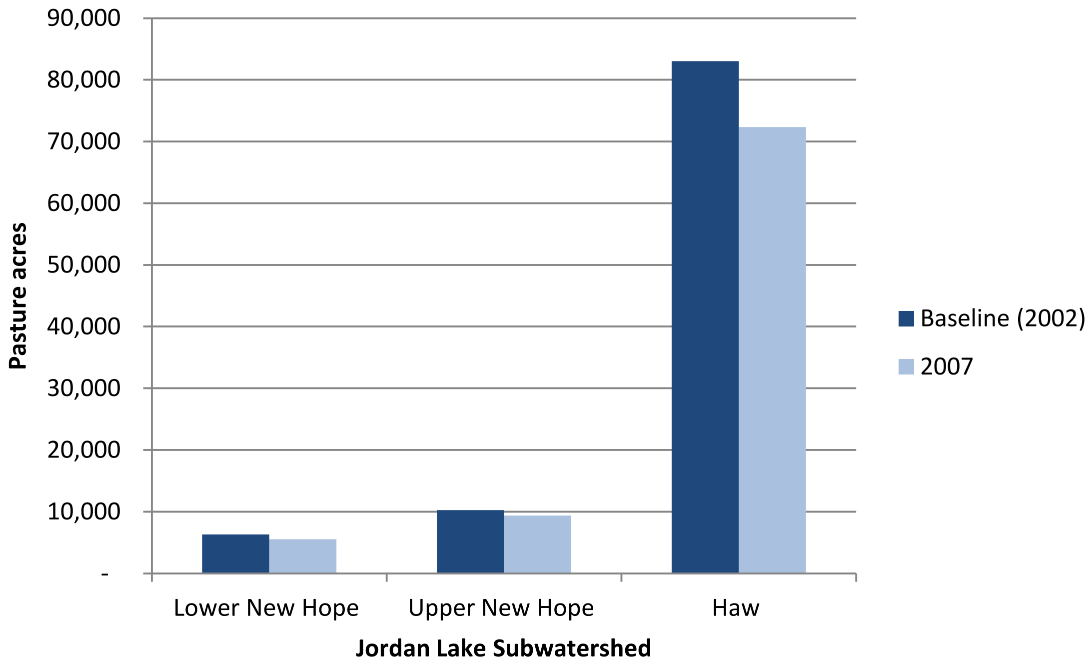
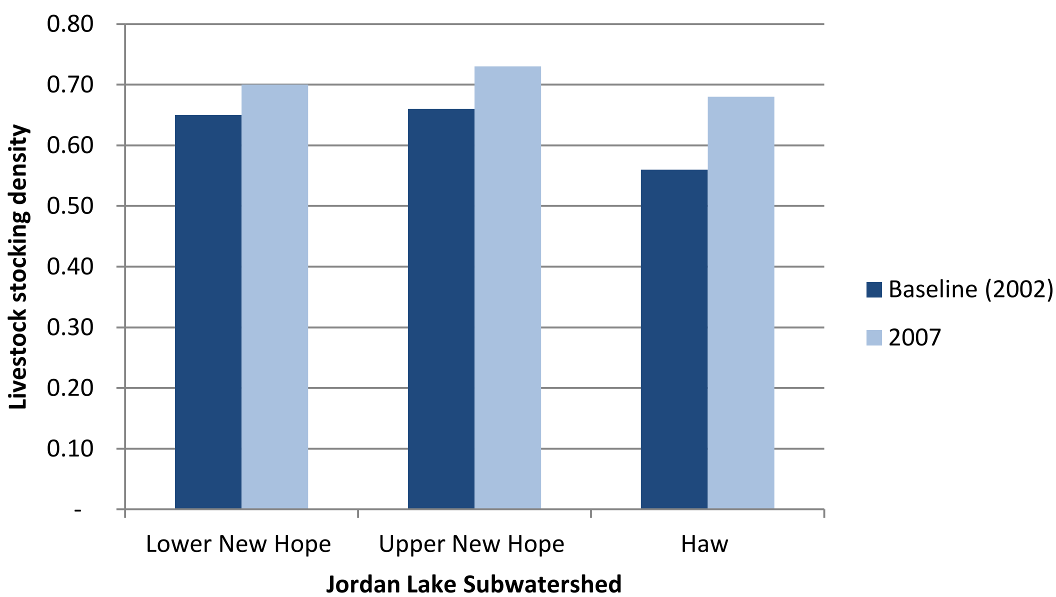


Figure 9. Livestock stocking density in the Jordan Lake Watershed, Baseline (2002) and 2007



To complete the pasture point system accounting method in each county, pasture BMPs funded by state and federal cost share programs are to be tracked annually and compiled every five years. Individual contracts are reviewed to compile pasture acres affected by each BMP.

According to the adopted methodology, for each county for each implementation period, acreage-weighted BMP point assignments will be aggregated and compared to baseline values to yield a county point reduction estimate. These county point values will then be acreage-weighted aggregated for each Jordan subwatershed and compared to subwatershed reduction goals.

Pasture BMPs implemented in 2002 served as the baseline for this analysis, and were compared to pasture BMPs implemented from 2003-2007. Pasture BMPs receive point reduction credit as described in Table 5. These buffer credits incorporate the most recent adjustments made to NLEW cropland accounting, which reflect current research estimating restored buffer net efficiency improvements. The data for this five year period is displayed in Table 6.

Table 5. Points nitrogen reduction from pastureland for different BMPs, Pasture Point System

Pasture BMP	Pasture points
Exclusion fencing with a 10’ stream setback	30 points
Exclusion fencing with a 20’ buffer	50 points
Exclusion fencing with a 30’ buffer	55 points
Exclusion fencing with a 50’ buffer	60 points
Exclusion fencing with a 100’ buffer	65 points

For the initial pastureland point system accounting, in the five years between releases of the Census of Agriculture, only the Lower New Hope Subwatershed met its target reduction goal of maintaining the baseline point value of 0. The Haw River Subwatershed came close to meeting its goal, with 5.0 points compared to the goal of 8 points, a difference of 3.0 points. While the Upper New Hope Subwatershed did not meet its goal with 0.3 points compared to the goal of 35 points, a difference of 34.7 points. Detailed information regarding county and subwatershed data is displayed in Table 6.

While this system was developed for the Tar-Pamlico River Basin, the Jordan Lake watershed is the first to employ the pastureland point system accounting method. The WOC will continue to monitor the accounting method and offer recommendations for improvements to the pasture points subcommittee as suggestions or new research arises. Several factors may affect why the pasture points are low in the Jordan Lake Watershed. The first factor is the amount of land already buffered in the Jordan Lake Watershed. According to a report completed in 2007, *Delineating Agriculture in the Lake Jordan River Basin,* the majority of agricultural land is already buffered. This study found that six of the counties had more than 75% of their agricultural land buffered, and that the average buffer width was greater than 50 feet.[1] Land that is already buffered is not captured in the baseline or 2007 reports, as the pastureland points system only measures BMPs installed and the affected acres of pasture associated with those practices. The second factor is the small size of the subwatersheds, this is particularly noticeable in the Lower and Upper New Hope Subwatersheds. Each of these subwatersheds has small acreages of pastureland, according to the 2007 Census of Agriculture; they are both below 10,000 acres. This limits the amount of land that can be excluded and buffered, as well as reduces the number of farmers that can be targeted for adoption of voluntary conservation practices. The third factor is that equine operations are not eligible for cost share assistance through federal programs, which are funded at a much higher level than state cost share programs. This is particularly important because horses are the second highest population of livestock in the watershed, following cattle.

On a positive note, local soil and water conservation district and NRCS staff have indicated that during the next reporting cycle in 2014, more livestock BMPs will be reported. This watershed, and the state as a whole, experienced a severe drought that had a significant impact on pasture operations. Additional funding was secured from state appropriations and grant sources for the installation of many pasture practices including livestock exclusion and associated buffers.

Table 6. Points nitrogen reduction from pastureland by county and Jordan Lake Subwatershed, Pasture Point System

County	Baseline 2002 Pasture Points	2007 Pasture Points	Pasture Points normalized by pastureland acres of subwatershed in county	Subwatershed point reduction goal	Goal status
Upper New Hope Subwatershed					
Chatham	0	0	0		
Durham	0	0	0		
Orange	0	1,375.0	0.3		
Wake	0	0	0		
Total	**0**	**1,375.0**	**0.3**	**35.0**	**Not meeting**
Lower New Hope Subwatershed					
Chatham	0	0	0		
Wake	0	0	0		
Total	**0**	**0**	**0**	**0**	**Meeting**
Haw Subwatershed					
Alamance	2,310.0	57,539.0	1.9		
Caswell	-	1,250.0	0.5		
Chatham	32,600.0	8,324.0	(1.9)		
Guilford	5,165.0	6,270.0	0.1		
Orange	4,573.0	2,945.0	(0.2)		
Rockingham	1,820.0	22,010.0	4.6		
Total	**46,468.0**	**98,338.0**	**5.0**	**8.0**	**Not meeting**

PHOSPHORUS LOSS ACCOUNTING

Phosphorus Indicators for CY2010

The qualitative indicators included in Table 7 show the relative changes in land use and management parameters and their relative effect on phosphorus loss risk in the watershed. This approach was recommended by the Phosphorus Technical Advisory Committee (PTAC) in 2005 due to the difficulty of developing an aggregate phosphorus tool parallel to the nitrogen NLEW tool. The PTAC reconvened in April 2010 to make minor revisions for the tool's use in this watershed and the approach was approved for use in the Jordan Lake Watershed by the Water Quality Committee of the EMC. This report includes phosphorus indicator data for the baseline period (1997-2001) and CY2010. Most of the parameters indicate less risk of phosphorus loss than in the baseline.

Contributing to the reduced risk of phosphorus loss is the reduction in the acres of tobacco, the decrease in the amount of animal waste phosphorus, and a movement to 90% conservation tillage on cropland in the watershed.

The soil test phosphorus median number reported for the watershed fluctuates each year due to the nature of how the data is collected and compiled. The soil test phosphorus median numbers shown in Table 7 are generated by using North Carolina Department of Agriculture and Consumer Services (NCDA&CS) soil test laboratory results from voluntary soil testing and the data is reported by the NCDA&CS. The number of samples collected each year varies. The data does not include soil tests that were submitted to private laboratories. The soil test results from the NCDA&CS database represent data from entire counties in the watershed, and have not been adjusted to include only those samples collected in the Jordan Lake Watershed.

Phosphorus Technical Assistance Committee (PTAC):

The PTAC's overall purpose was to establish a phosphorus accounting method for agriculture in the basin. It determined that a defensible, aggregated, county-scale accounting method for estimating phosphorus losses from agricultural lands was not feasible due to "the complexity of phosphorus behavior and transport within a watershed, the lack of suitable data required to adequately quantify the various mechanisms of phosphorus loss and retention within watersheds of the basin, and the problem with not being able to capture agricultural conditions as they existed in 1991. The PTAC instead developed recommendations for qualitatively tracking relative changes in practices in land use and management related to agricultural activity that either increase or decrease the risk of phosphorus loss from agricultural lands in the basin on an annual basis.

Table 7. Relative Changes in Land Use and Management Parameters and their Relative Effect on Phosphorus Loss Risk in the Jordan Lake Watershed

Parameter	Units	Source	Baseline (average 1997-2001)	2010	Percent change	2010 P Loss Risk +/-
Cropland	Acres	NC Ag Statistics	87,384	98,573	13%	+
Cropland conversion (to grass & trees)	Acres	USDA-NRCS & NCACSP	1,359	1,822	34%	-
CRP / WRP* (cumulative)	Acres	USDA-NRCS	Federal data not able to be reported	986.9	N/A	N/A
Conservation tillage**	Acres	USDA-NRCS & NCACSP	1,997	17,635	783%	-
Vegetated buffers (cumulative)	Acres	GIS analysis	54,212	52,831	-3%	+
Tobacco acres	Acres	USDA-NRCS & NCACSP	7,667	4,647	-39%	-
Scavenger crop***	Acres	USDA-NRCS & NCACSP	0	0	0%	N/A
Animal waste P	lbs of P/ yr	NC Ag Statistics	9,809,802	5,608,723	-43%	-
Soil test P median	mg/kg	NCDA& CS	72	71	-1%	-

* CRP/WRP data during the baseline period was not able to be queried. Once contracts expire, they are removed from the datalayer where this information is stored.
**Conservation tillage is being practiced on additional acres but this number only reflects acres under active cost share contracts, not acres where contracts have expired or where farmers have adopted the use of conservation tillage without cost share assistance.
***Nutrient scavenger crop acreage only reflects acres under active cost share contracts, not acres where farmers plant scavenger crops without cost share assistance, primarily following tobacco.

The WOC finds that the decreased risk of P loss is associated with the following three important parameters:

- increase in conservation tillage acreage,
- decrease in animal waste phosphorus and
- decrease in tobacco acreage.

These parameters sufficiently outweigh the increased P loss risk associated with the watershed cropland increase for this time period. The WOC recommends that no additional management actions be required of agricultural operations in the watershed at this time to comply with the phosphorus goals of the agriculture rule.

The WOC will continue to track and report the identified set of qualitative phosphorus indicators to the Division of Water Quality (DWQ) annually, and to bring any concerns raised by the results of this effort to the DWQ's attention as they arise, along with recommendations for any appropriate action. The WOC expects that BMP implementation may continue to increase throughout the watershed in future years, and notes that BMPs installed for nitrogen, pathogen and sediment control often provide significant phosphorus benefits as well.

The Jordan Lake Watershed Oversight Committee also initially recommended adding tracking of the annual application of human biosolids, but ultimately removed this element from the tracking methodology due to lack of readily accessible biosolids data. Currently, biosolids applicators submit paper copy annual reports containing application and site information; however, due to limited resources NC DENR is not keying the information into a database. To include this information would require new resources to mine the historical and enter new hard copy data. To date, resources have not been obtained for this purpose. When digital biosolids information becomes available the human biosolids component will be tracked as a separate component of the phosphorus accounting. In an effort to improve nutrient management strategies that are part of the residuals (biosolids) application program, NC DENR has formed a stakeholders group to evaluate available nutrient management tools for phosphorus and make recommendations for future phosphorus management of biosolids applications.

BEST MANAGEMENT PRACTICE IMPLEMENTATION

Not all types of nutrient and sediment-reducing best management practices (BMPs) are tracked by NLEW. Other BMPs include: livestock-related nitrogen and phosphorus reducing BMPs, BMPs that reduce soil and phosphorus loss, and BMPs that do not have enough scientific research to support estimating a nitrogen benefit. The WOC believes it is worthwhile to recognize these practices. Table 8 identifies BMPs and tracks their implementation in the watershed since the end of the baseline period.

Table 8. Best management practices installed, Jordan Lake Watershed*

Conservation practice	Units	Haw: 2002-2010	Lower New Hope: 2002-2010	Upper New Hope: 2002-2010
Ag road repair-stabilization	feet	2,880.0	-	-
Agricultural pond restoration/repair	units	17.0	-	-
Closure-waste impoundments	units	17.0	-	-
Conservation cover	acres	756.1	20.0	9.5
Constructed wetland	acres	2.1	-	-
Cover crop	acres	2,292.2	-	56.3
Critical area planting	acres	65.0	0.1	0.2
Cropland conversion-grass	acres	932.8	36.5	-
Cropland conversion-trees	acres	842.1	10.2	-
Diversion	feet	4,034.0	574.0	464.0
Fencing (USDA programs)	feet	6,741.0	-	-
Field border	acres	138.5	-	0.4
Filter strip	acres	0.4	-	-
Grassed waterway	acres	288.3	-	0.2
Habitat management	acres	284.6	3.3	9.5
Livestock exclusion	feet	85,130.0	3,061.0	814.0
Nutrient management	acres	5,109.5	-	-
Nutrient management plan	number	29.0	-	-
Pasture renovation	acres	2,763.1	-	58.9
Pastureland conversion to trees	acres	31.2	-	-
Pond	number	1.0	-	-
Prescribed grazing	acres	3,352.0	-	-
Riparian forest buffer	acres	84.5	-	-
Sediment control basin	units	2.0	-	-
Sod-based rotation	acres	9,667.7	-	11.2
Streambank and shoreline protection	acres	16,905.0	-	-
Terrace	feet	9,439.0	-	10,970.0
Tillage management	acres	17,478.7	5.8	150.9

*Values represent active contracts in State and Federal cost share programs.

Additional BMPs may exist in the watershed as producers may maintain practices after the life of a cost share contract, and other practices are installed without cost share assistance.

LOOKING FORWARD

The Jordan Lake WOC will continue to improve rule implementation, relying heavily on the local soil and water conservation districts who work directly with farmers to assist with best management practice design and installation.

WOC recognizes the dynamic nature of agricultural business:

- Urban encroachment (i.e., crop selection shifts as fields become smaller).
- Age of farmer (i.e, as retirement. approaches farmers may move from row crops to cattle).
- Changes in the world economies, energy 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 sustainability).
- Plant disease or pest problems (i.e., viruses or foreign pests).

Because cropping shifts are susceptible to various pressures, the WOC is working with all counties to continue BMP implementation on both cropland and pastureland that provides for a lasting reduction in nitrogen and phosphorus loss in the watershed while monitoring cropping changes.

The committee overseeing the development of NLEW has been reviewing BMP efficiencies credited by the nutrient accounting software. This review is part of the ongoing examination of practices utilized to assess cropland's nutrient losses. Any recommended changes from the NLEW committee will be incorporated into nutrient accounting in future crop years.

The WOC will incorporate recommendations of NC DENR's stakeholder group on evaluating available nutrient management strategies that are part of the residuals (biosolids) application program and incorporate biosolid application data in agriculture's phosphorus accounting when available electronically.

The committee will be evaluating 2012 Census of Agriculture data, when published in 2014, for the next 5-year pasture point analysis for each subwatershed. The committee supports additional research on accounting procedures for pasture operations, including how to measure and report buffers on pastureland.

A subcommittee of the Falls and Jordan Lake WOCs is working with DWQ on issues regarding trading nutrient offsets that arise from trades involving agricultural land.

Funding is an integral part in the success of this strategy. There are no technicians funded to conduct nutrient management data collection. Further the staff position in the Division of Soil and Water Conservation previously assigned to work on Jordan Lake reporting was reassigned due to significant losses of positions in this division due to budget reductions.

The WOC considers this to be important work, and supports future funding to continue the annual reporting requirements.