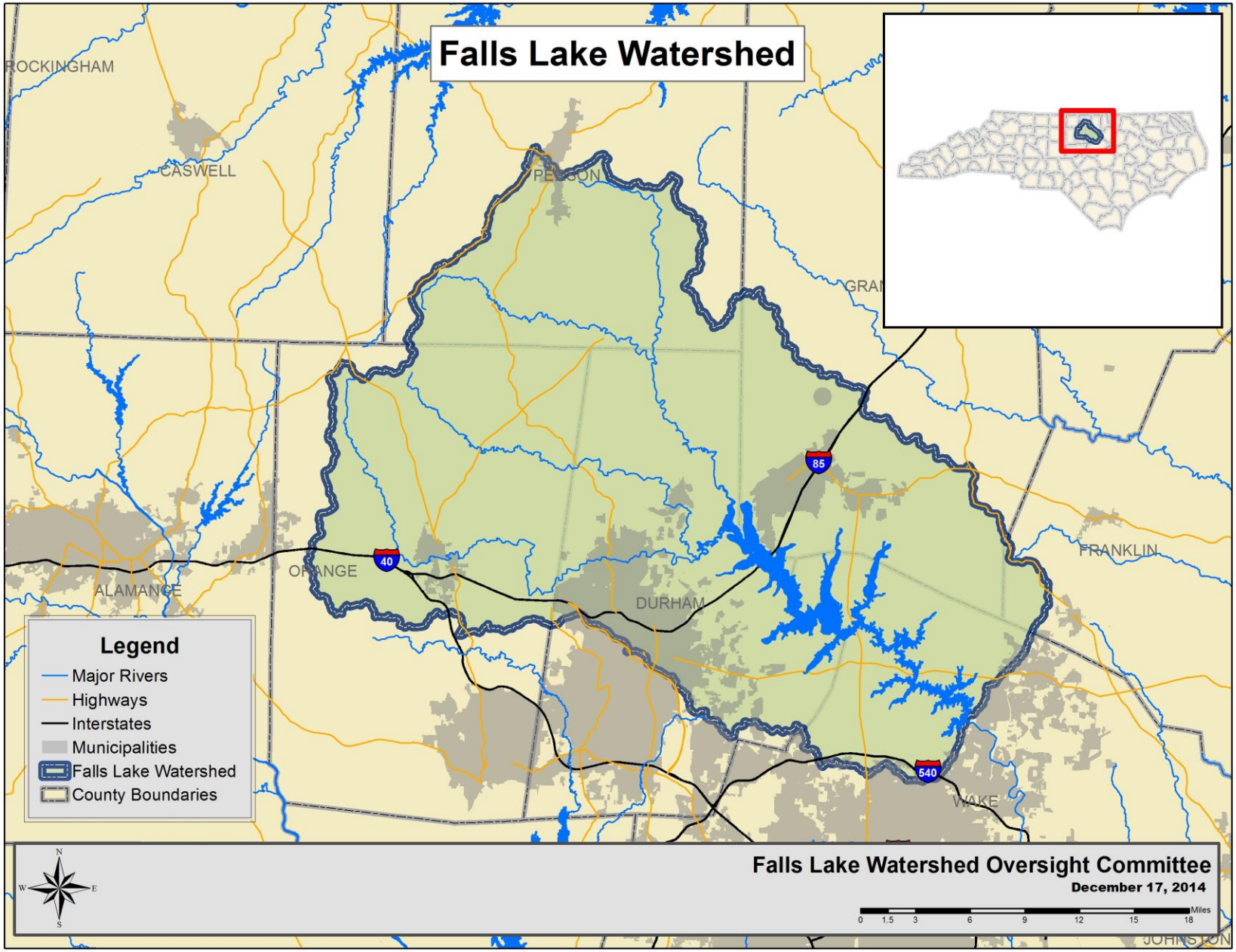
NCDA&CS

2016 Annual Progress Report (Crop Year 2015) on Agricultural Operations' Stage 1 Reductions for the Falls Lake Agriculture Rule (15 A NCAC 02B.0280)

A Report to the Environmental Management Commission from the Falls Lake Watershed Oversight Committee: Crop Year 2015


Falls Lake Watershed
ROCKINGHAM
CASWELL
PERSON
GRANVILLE
ORANGE
ALAMANCE
DURHAM
FRANKLIN
WAKE
JOHNSTON
85
40
540
Legend
Major Rivers
Highways
Interstates
Municipalities
Falls Lake Watershed
County Boundaries
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Falls Lake Watershed Oversight Committee
December 17, 2014
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Summary

This report provides the annual progress report of collective progress made by the agricultural community to reduce nutrient losses toward compliance with Stage 1 of the Falls Lake Agriculture rule. For this report, the Falls Lake Watershed Oversight Committee (WOC) oversaw the application of accounting methods approved by the Environmental Management Commission's Water Quality Committee in March 2012 to estimate changes in nitrogen loss and phosphorus loss trends in the Falls Lake Watershed. This report is for the period between the strategy baseline (2006) and the most recent crop year (CY)[1] for which data was available, 2015. The Falls Lake WOC received and approved crop year CY2015 annual reports from six counties as part of the Falls Lake Agriculture rule, which is part of the Falls Reservoir Water Supply Nutrient Strategy. To produce this report, Division of Soil and Water Conservation staff received, processed and compiled baseline and current-year reports from agricultural staff in six counties, and the WOC compiled the information and prepared this report. Agriculture has been successfully decreasing nutrient losses in the Falls Lake watershed. In CY2015, agriculture collectively exceeded its 20% Stage I nitrogen reduction goal for cropland, with a 70% reduction compared to the 2006 baseline. All six counties exceeded the mandated 20% reduction goal this year.

Falls Lake Watershed Oversight Committee Composition, Falls 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 Resources
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

Reductions in nitrogen have been achieved through an overall decrease in cropland in production, a decrease in nitrogen application rates, and an increase in best management practices (BMPs) such as 20 and 50-foot riparian buffers. Since the baseline, reported cropland acres decreased in the watershed by 24,761, of which an estimated 4,708 acres of agricultural land were lost to development. Phosphorus qualitative indicators demonstrate that there is no increased risk of phosphorus loss, with a 17% and 3% decrease in animal waste phosphorus production and tobacco acreage, respectively, and a 45% increase in cropland conversion to grass and trees since the 2006 baseline.

[1] The 2015 crop year began in October 2014 and ended in September 2015.

Rule Requirements and Compliance

In January 2011, the permanent Agriculture Rule that is part of the Falls Reservoir Water Supply Nutrient Strategy became effective. The Agriculture Rule provides for a collective strategy for farmers to meet nitrogen loss reduction goals in two stages. The strategy goal is to reduce the average annual load of nitrogen and phosphorus to Falls Lake from 2006 baseline levels. Stage I requires that agriculture reach a goal of 20% nitrogen loss reduction and 40% phosphorus reduction by year 2020. This Stage I nitrogen goal requires a 20% reduction from pasture sources. Stage II sets reduction goals of 40% and 77% for nitrogen and phosphorus, respectively, by year 2035, which includes a 40% reduction from pasture sources for the watershed. A Watershed Oversight Committee (WOC) was established to guide the implementation of the rule and to assist farmers with complying with the rule.

Falls Lake NSW Strategy:
The Environmental Management Commission (EMC) adopted the Falls Reservoir Water Supply Nutrient Strategy rules in 2011. The strategy goal is to reduce the average annual load of nitrogen and phosphorus to Falls Lake from 2006 baseline levels. In addition to point source rules, mandatory controls were applied to addressing non-point source pollution in agriculture, urban stormwater, and riparian buffer protection. The management strategy was modeled after similar strategies for the Neuse River, Tar-Pamlico River, and Jordan Lake.

All county Local Advisory Committees (LAC) submitted their fifth annual reports to the WOC in August 2016. Collectively, agriculture in the six counties is meeting the cropland nitrogen loss reduction goal, with a 70% reduction. Qualitative indicators for phosphorus suggest there is no increased risk of phosphorus loss from agriculture in the watershed.

In August 2016 the WOC accepted the recommendation of the Pasture Points Committee to revise the pasture accounting method. The “pasture point” system was replaced with a system that utilizes the Nitrogen Loss Estimation Worksheet (NLEW) to estimate reductions in nitrogen loss over time. This calculation is based on data collected from the USDA Census of Agriculture, the American Society of Agricultural and Biological Engineers, researchers at NC State University, the Interagency Nutrient Management Committee, and local field staff.

Scope of Report and Methodology

The estimates provided in this report represent county-scale calculations of nitrogen loss from cropland agriculture in the watershed made by the NC Division of Soil and Water Conservation (DSWC) using the ‘aggregate’ version of NLEW and adjusted for the percentage of each county in the Falls Lake Watershed. NLEW is an accounting tool developed to meet the specifications of the Neuse Rule and approved by the Environmental Management Commission’s (EMC) Water Quality Committee in March 2012 for use in the Falls Lake Watershed. The NLEW development team included interagency technical representatives of the NC Division of Water Resources (DWR), NC Division of Soil and Water Conservation (DSWC), United States Department of Agriculture (USDA)-Natural Resources Conservation Service (NRCS) and was led by NC State University (NCSU) Soil Science Department faculty. NLEW captures application of both inorganic and animal waste sources of fertilizer to cropland. It is an “edge-of-management unit” accounting tool that estimates changes in nitrogen loss from cropland and pastureland, 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 phosphorus, and are described later in the report.

In 2016 the Division of Soil and Water Conservation worked with NC State University, NCDA&CS Emergency Programs staff, and the NCSU Cooperative Extension Service to update NLEW software version 5.33b to a new version 6.0, which is a web-based platform that incorporates updated yield expectations and nitrogen use efficiencies for crops. The NLEW software has been updated from outdated programming language and is now being housed on NCDA&CS servers. Revised realistic yield and nitrogen use efficiency data from NCSU was incorporated, and some minor calculation errors were corrected for corn, sweet potatoes, and sweet corn. Beneficial updates include server storage of annual reports, streamlined data export, and ongoing end-user data maintenance capabilities, which should enable DSWC and the WOC to incorporate new realistic yield expectations and nitrogen use efficiencies quickly and efficiently as future research is released and refined.

Nitrogen Reduction from Cropland from 2006 Baseline for CY2015

All counties submitted their fifth progress reports to the WOC in August 2016. In CY2015 agriculture achieved a 70% reduction in nitrogen loss from cropland compared to the average 2006 baseline. Table 1 lists each county's baseline, CY2014 and CY2015 nitrogen (lbs/yr) loss values from cropland, along with nitrogen loss percent reductions from the baseline in CY2014 and CY2015, and Figure 1 shows annual loss percent reductions per year since CY2011, calculated with the two different versions of NLEW.

Figure 1. Collective Nitrogen Loss Reduction Percent 2011 to 2014, Falls Lake Watershed.

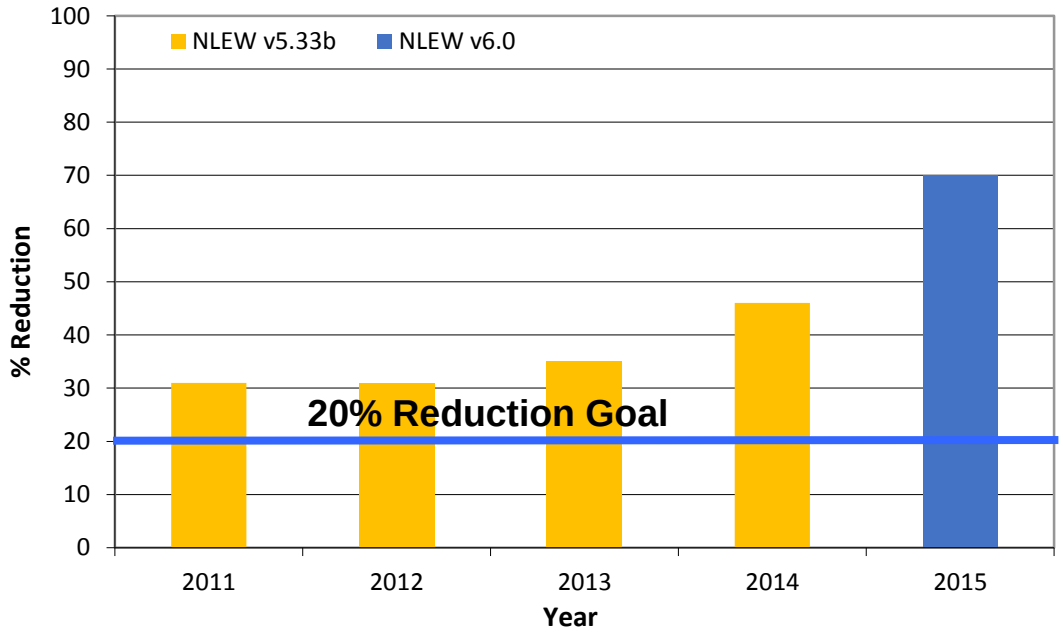

Table 1. Estimated reductions in agricultural (cropland) nitrogen loss from baseline (CY2006) for CY2014 and CY2015, Falls Lake Watershed

County	Baseline N Loss (lb) NLEW v6.0	CY2014 N Loss (lb) † NLEW v5.33b	CY2014 N Reduction (%)†	CY2015 N Loss (lb)* NLEW v6.0	CY2015 N Reduction (%)
Durham	146,090	115,682	15%	39,312	73%
Franklin	11,772	3,496	70%	3,528	70%
Granville	127,704	7,783	94%	26,701	79%
Orange	347,402	168,891	51%	109,040	69%
Person	484,123	290,598	40%	139,231	71%
Wake	52,405	41,358	10%	34,766	34%
Total	1,169,495	627,808†	46%†	352,578	70%

**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 an agricultural management unit, based on NLEW calculations. This is not an in-stream loading value.*

† *CY2014 values were calculated with sweet potato acres removed from current and baseline year figures. The numbers shown were copied from the 2015 report for the sake of consistency, but the CY2014 reductions shown cannot be compared to the baseline nitrogen loss shown in the table, which currently includes sweet potatoes.*

Notably, Durham, Franklin, Granville, and Person Counties are currently reporting more than 70% nitrogen loss reduction from baseline. These counties have lost 71%, 81%, 76%, and 74% of their hay acres, respectively. Some of these acres may have been lost to development, or they may currently be idle and not receiving fertilizer application. It is possible that some of these acres are now grazed as pasture, which means that they are now accounted for in the pasture NLEW reporting framework described later in this report. Only non-grazed hay acres are accounted for in the cropland NLEW reduction calculation. In addition, Granville and Person Counties have lost 61% and 73% of their corn acres, respectively. Both of these crops generally receive higher nitrogen inputs, so the loss of this acreage is likely to significantly impact annual nitrogen loss reduction calculations. Overall, the Falls Lake Watershed is reporting a cropland nitrogen loss reduction of 70% for CY2015.

Best Management Practice Implementation

Agriculture is credited with different nitrogen reduction efficiencies, expressed as percentages, for riparian buffer widths ranging from 20 feet to 100 feet. NLEW versions 5.33b and 6.0 for the Neuse River Basin provide 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 (see Table 2). Note that these percentages represent the net or relative percent improvement in nitrogen removal resulting from riparian buffer implementation.

Table 2. Buffer Width Options and Nitrogen Reduction Efficiencies in NLEW

Buffer Width	NLEW % N Reduction
20'	20%
30'	25%
50'	30%
100'	35%

Figure 2 illustrates the amount of buffers on cropland in the baseline (2006) and CY2015. Overall, total acres of buffers have slightly increased since the baseline (4.4%). Acres of buffers of 20 and 50 foot widths have increased, while 30 and 100 foot buffers have remained unchanged. The reported buffer acres do not take into account the entire drainage area treated by buffers in the piedmont which is generally 5 to 10 times greater than the actual acres of the buffers shown in Figure 2.[2] Riparian buffers have many important functions beyond being effective in reducing nitrogen.[3] 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.[4] In addition, riparian buffers can reduce phosphorus and sediment as they move through the buffer and provide other critically important functions such as wildlife habitat and stream shading.[5]

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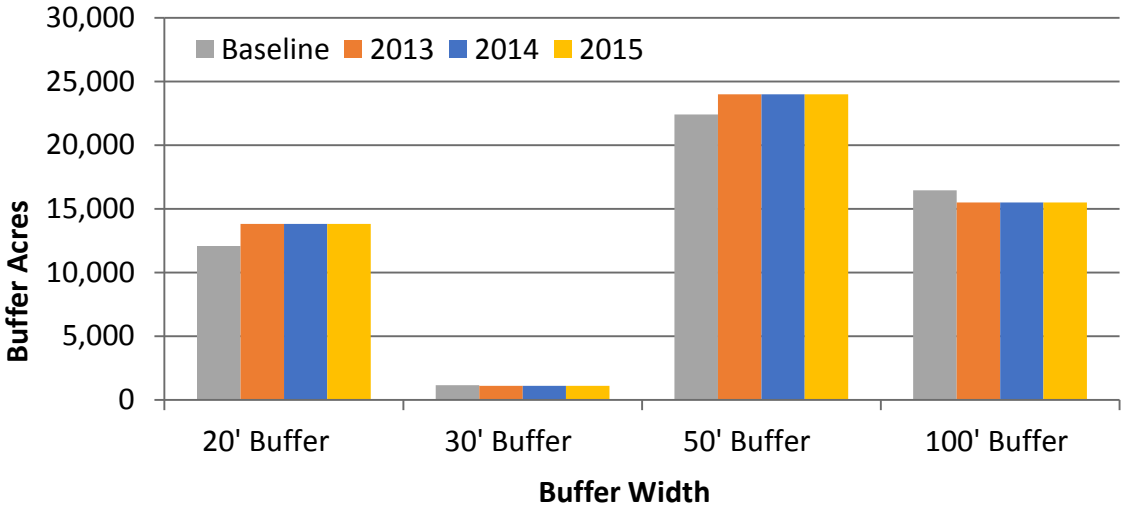
[2] Bruton, Jeffrey Griffin. 2004. Headwater Catchments: Estimating Surface Drainage Extent Across North Carolina and Correlations Between Landuse, Near Stream, and Water Quality Indicators in the Piedmont Physiographic Region. Ph.D. Dissertation. Department of Forestry and Environmental Resources, North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

[3] B. Sweeney et al., 2004, Riparian deforestation, stream narrowing, and loss of stream ecosystem services, PNAS 101:39, 14132-14137; Sweeney and Newbold, 2014.

[4] Osmond, D., D. Meals, D. Hoag, and M. Arabi. 2012. How to Build Better Agricultural Conservation Programs to Protect Water Quality: The NIFA-CEAP Experience. Soil and Water Conservation Society, Ankeny, IA.

[5] T.B. Spruill, 2004, Effectiveness of riparian buffers in controlling ground-water discharge of nitrate to streams in selected hydrogeologic settings of the North Carolina Coastal Plain, Water Science and Technology 49:3, 63-70;

Figure 2. Nitrogen Reducing Buffers installed on Croplands from CY2013 through CY2015, compared to Baseline (CY2006), Falls Lake Watershed*



Fertilization Management

Increased fertilizer cost has impacted the application rates of nitrogen on farms in the Falls Lake Watershed. For most crops, farmers have reduced their nitrogen application rates from baseline levels. Figure 3 displays the nitrogen application rates in pounds per acre for the major crops in the watershed. Nitrogen application rates for bermuda and fescue hay are 73 and 54 pounds/acre lower, respectively, than during the baseline. Nitrogen rates on corn decreased from CY2014, and tobacco and wheat application rates remained relatively unchanged from CY2014. Fertilizer rates will be revisited annually by county local advisory committees using data from farmers, commercial applicators and state and federal agencies' professional estimates.

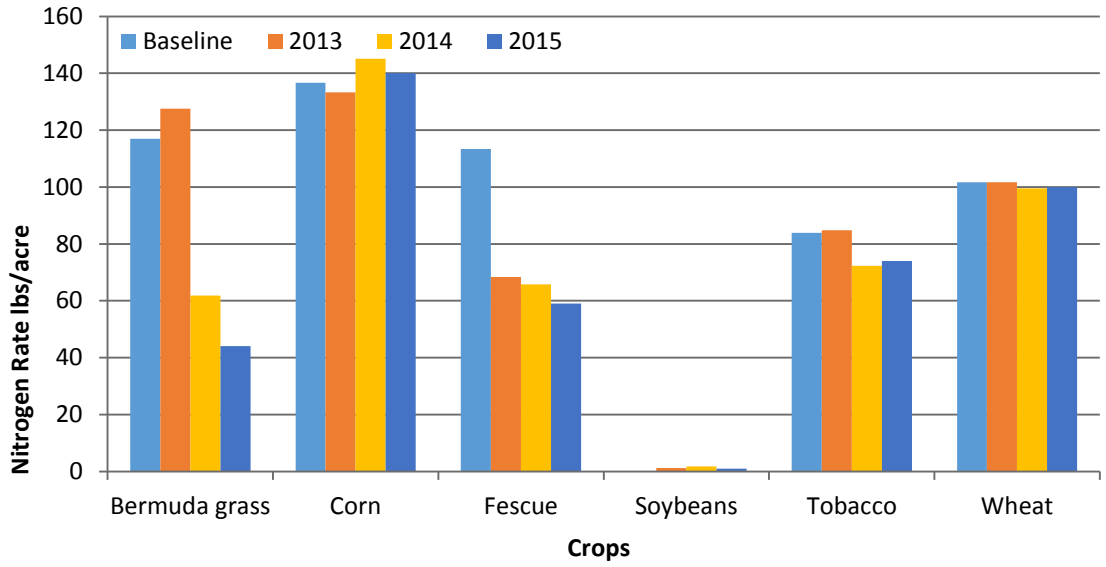
Factors Identified by LACs Contributing to Reduced Nitrogen Application Rates since the Baseline Year:

- Rising fertilizer costs and fluctuating farm incomes.
- Mandatory waste management plans.
- The federal government tobacco quota buy-out reducing tobacco acreage.
- Neuse Nitrogen Strategies.

Agriculture in the six counties within the Falls Lake watershed is focused primarily on pasture-based systems, with hay and/or pasture ranging from 42-74% of the agricultural land use. On hay and pasture nitrogen application rates are significantly less than NC State University recommendations and only small amounts of phosphorus are added. Thus, it appears that hay production acres are underfertilized in the Falls Lake Watershed.[6]

[6] Osmond, D.L., K. Neas. 2011. Delineating Agriculture in the Neuse River Basin. Prepared for NC Department of Environment and Natural Resources (NCDENR), Division of Water Quality. http://content.ces.ncsu.edu/delineating-agriculture-in-the-neuse-river-basin

Figure 3. Average annual nitrogen fertilization rate (lb/ac) for agricultural crops for the baseline (2006), 2012, 2013, and 2014, Falls Lake Watershed

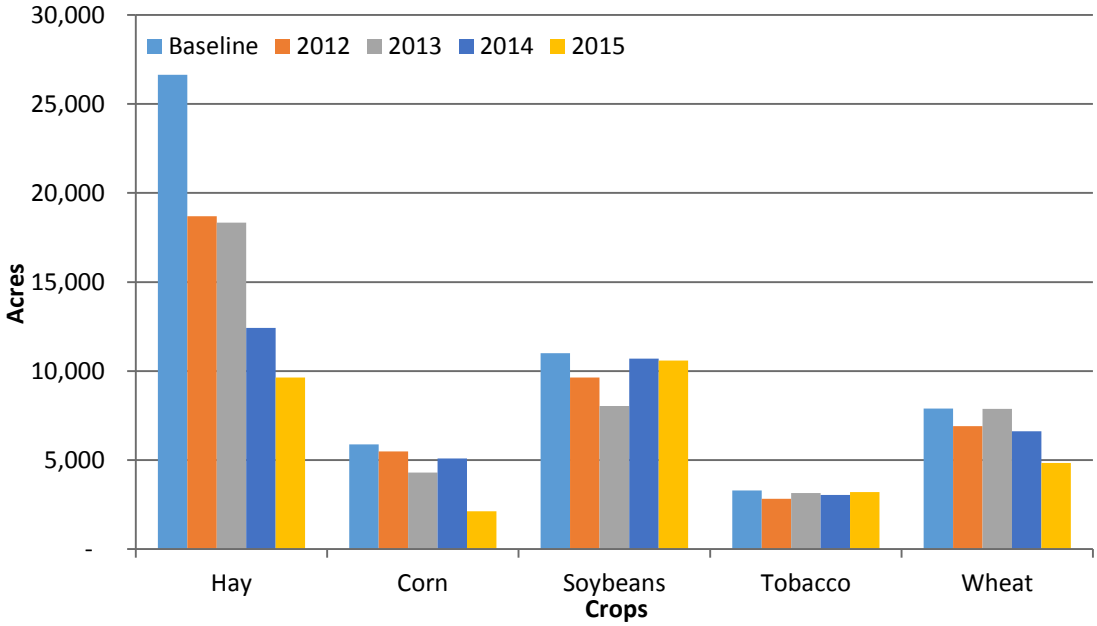


Cropping Shifts

The LACs recalculate the cropland acreage annually by utilizing crop data reported by farmers to the Farm Service Agency. Because each crop type requires different amounts of nitrogen and uses applied nitrogen with a different efficiency rate, changes in the mix of crops grown can have a significant impact on the cumulative yearly nitrogen loss reduction. The BOC anticipates that the basin will see additional crop shifts in the upcoming year based on changing commodity prices and wet weather.

The price of corn remained low in CY2015, so corn acres, which require higher nitrogen inputs, decreased compared to CY2014. Soybean acres, which require no nitrogen input, remain very close to baseline. These trends have helped reduce overall nitrogen loss. In addition, an extremely wet fall prevented many farmers from accessing their fields in time to plant a crop of winter wheat. In most cases wheat acres are "double cropped" with soybeans, which means that wheat acres are planted on the same acreage before a spring soybean crop. In CY2015, soybean acreages were accounted for in these double cropped systems, but some of those acres were not fertilized over the winter months where a wheat crop was not planted. This resulted in an overall decrease of over 1,700 wheat acres between CY2014 and CY2015. A host of factors from individual to global determine crop choices. Figure 4 shows crop acres and shifts for CY2015 compared to the baseline. The reported acres of all major crops have decreased by over 24,328 acres in the watershed since the baseline. None of the hay acres reported in this table are grazed by livestock.

Figure 4. Reported Acreage of Major Crops for the Baseline (2006), 2012-2015, Falls Lake Watershed



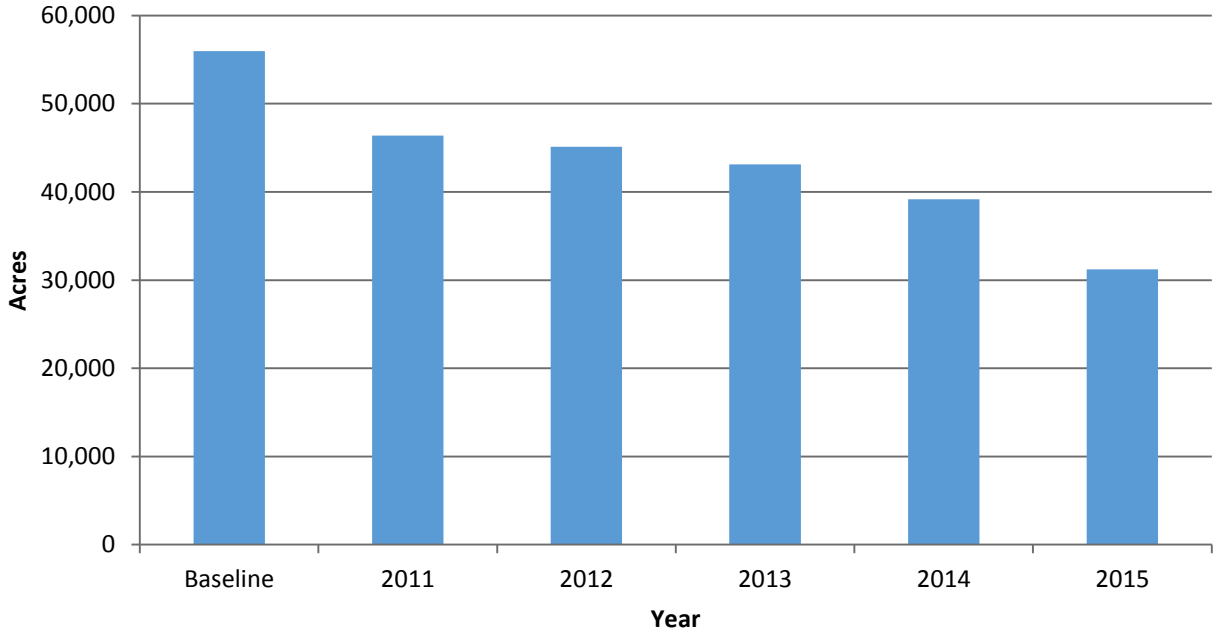
Land Use Change to Development and Cropland Conversion

The number of cropland acres fluctuates every year in the Falls Lake Watershed due to cropland conversion and development. Each year, some cropland is either permanently lost to development or converted to grass or trees and likely to be ultimately lost from agricultural production. Data regarding land use change since the baseline is summarized below.

It is estimated that since the 2006 baseline there has been a decrease in crop production of 24,761 reported acres (44% of total cropland). Of that, 4,708 (19% of cropland loss) agricultural acres have been permanently lost to development. Through state and federal cost share programs, 2,207 cropland acres (8% of cropland loss) were converted to grass or trees. The remaining 28% cropland reduction, which includes 10,060 acres of idle land, could potentially be brought back into agricultural production.

The estimates for agricultural land lost to development come from methodologies developed at the individual county level based on available information and the many and diverse local government 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 5. Total Reported Cropland Acres in the Falls Lake Watershed, Baseline (2006), 2011-2015



Phosphorus Indicators for CY2015

The qualitative indicators included in Table 3 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 and the PTAC reconvened to make minor revisions for the tool's use in the Jordan Lake Watershed in April 2010. This modified approach was approved for use in the Falls Lake Watershed by the Water Quality Committee of the EMC. This report includes phosphorus indicator data for the baseline period (2006), CY2013, CY2014 and CY2015. Most of the parameters indicate less risk of phosphorus loss from agricultural management units than in the baseline period.

Factors contributing to the reduced risk of phosphorus loss in the Falls Lake Watershed include:

- Tobacco acres were reduced by 3%
- Animal waste P was reduced by 17% from livestock and poultry
- Cropland conversion to other uses

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 3 are from agricultural operations and 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 Falls Lake Watershed.

Phosphorus Technical Assistance Committee (PTAC):
The PTAC's overall purpose was to establish a phosphorus accounting method for agriculture in the Tar-Pamlico River 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." (1991 was the Tar-Pamlico Basin's baseline year.) 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. This is the approved approach for the Falls Lake Watershed.

Table 3. Relative Changes in Land Use and Management Parameters and their Relative Effect on Phosphorus Loss Risk in the Falls Lake Watershed

Parameter	Units	Source	Baseline 2006	CY2013	CY2014	CY2015	Percent '06-'15 change	CY2015 P Loss Risk +/-
Reported Cropland	acres	FSA, LAC	55,969	43,136	39,179	31,208	-44%	-
Cropland conversion (to grass & trees)	acres	USDA-NRCS & NCACSP	1,527	1,853	1,853	2,207	45%	-
CRP / WRP (cumulative)	acres	USDA-NRCS	0	0	0	0	0%	N/A
Conservation tillage*	acres	USDA-NRCS & NCACSP	26,787	19,228	19,607	19,874	-26%	+
Vegetated buffers (cumulative)	acres	USDA-NRCS & NCACSP	52,139	54,419	54,420	54,420	4%	-
Scavenger crop	acres	LAC	0	605	599	1,190	1,190%**	-
Tobacco	acres	FSA, LAC	3,288	3,145	3,036	3,202	-3%	-
Animal waste P	lbs of P/ yr	NC Ag Statistics	586,612	546,008	487,203	489,061	-17%	-
Soil test P median	P Index	NCDA& CS	77	67	65	68	-12%	-

** 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. Based on field office reports, conservation tillage acres remain high even after contracts expire due to farmer satisfaction with the practice after initial implementation.[7] Despite the reduction in reported tillage acres, a higher percentage of agricultural land is currently being cultivated with reduced tillage than was reported during the baseline due to the overall reduction in agricultural acres. By this metric, the phosphorus loss risk remains negative.*
***The percent change for scavenger crop acres is assumed to have increased from 1 due to the problem with calculating a percentage difference from zero.*

Given the key role of phosphorus in the Falls Lake nutrient strategy, the Falls WOC recommends that phosphorus accounting and reporting follow a three-pronged approach:

1. Annual Qualitative Accounting: Conduct annual qualitative assessment of likely trends in agricultural phosphorus loss in the Falls watershed relative to 2006 baseline conditions using the method established by the 2005 PTAC report that added tobacco acreages and removed water control structures.

[7] Osmond, D.L., K. Neas. 2011. Delineating Agriculture in the Neuse River Basin. Prepared for NC Department of Environment and Natural Resources (NCDENR), Division of Water Quality. http://content.ces.ncsu.edu/delineating-agriculture-in-the-neuse-river-basin

2. Phosphorus Loss Assessment Tool (PLAT): The PLAT has been developed to assess potential P loss from cropland to water resources. A survey of the Falls Lake watershed counties was conducted in 2010, with the next survey to be conducted in the future if funding is available. The results of the 2010 survey demonstrated that the potential for phosphorus loss is very low (< 0.35 lbs/ac/yr) for four of the five counties surveyed. Phosphorus loss in Orange County is rated at the low end of the medium range (> 1 lb/ac/yr). Even with the installation of buffers along all streams and the discontinuation of phosphorus application (fertilizer, biosolids, or animal waste), there would be limited potential for additional phosphorus loss reduction.
3. Improved understanding of agricultural phosphorus management through studies using in-stream monitoring: quantitative in-stream monitoring should be conducted. Such monitoring is contingent upon the availability of funding and staff resources. An appropriate water quality monitoring design would be a paired-watershed study of subwatersheds with only agricultural land use. This design would allow estimates of phosphorus loading for different management regimes and load reductions after conservation practices have been implemented. However, funding for this study is currently unavailable.

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 Resources (DWR) annually, and as directed by the rule to the Environmental Management Commission. 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.

Pasture Accounting

The Falls Lake WOC adopted pasture accounting methodology developed during the Jordan Lake Agriculture Rule reporting process and first implemented this methodology for the 2013 Falls Lake Agriculture Rule Progress Report. In recent years the Pasture Points Committee was reconvened with membership 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 Resources (DWR), NC Department of Agriculture and Consumer Services (NCDA&CS), and Orange Soil and Water Conservation District. After reviewing newly available data sources and scrutinizing existing research findings, the subcommittee recommended a methodology change for the 5-year accounting process. The pasture point subcommittee found that:

- The pasture point system was adopted separate from NLEW due to data limitations in the applicability of NLEW to pasture systems. New research and a better understanding of USDA data sources, however, have enabled more accurate documentation of animal waste nitrogen content across the state.
- Because pasture acre and animal number totals are still reported only on a 5-year basis in the Census of Agriculture, pasture accounting will continue to be reported every 5-years. For Falls Lake, the baseline period has been accepted as 1997-2007.
- Nitrogen rates will be a combination of fertilizer nitrogen plus nitrogen deposited from pastured animals. Inorganic fertilizer application rates are determined by local field staff. Animal-derived

nitrogen will be calculated based on animal type from animal waste generation values developed by the American Society of Agricultural and Biological Engineers and volatilization coefficients of the animal nitrogen source developed by NC State University. Total nitrogen inputs will be calculated at the county scale. Total nitrogen loss estimates will be calculated using NLEW and compared against the 1997-2007 baseline period.

- 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 acres within livestock exclusion systems which have been implemented during each 5-year period.
- Livestock exclusion systems will be assigned the nitrogen reduction rates specified in Table 4[8]. These reduction percentages include the elimination of direct deposition of waste into surface waters by livestock in addition to the filtration of nitrogen by vegetated buffer areas.

Table 4. Points nitrogen reduction from pastureland for different BMPs, Pasture Point System

Pasture BMP	N Reduction
Exclusion fencing with a 10' stream setback	30%
Exclusion fencing with a 20' buffer	35%
Exclusion fencing with a 30' buffer	40%
Exclusion fencing with a 50' buffer	45%
Exclusion fencing with a 100' buffer	50%

Nitrogen loss estimates for the 1997-2007 and 1997-2012 periods are presented in Table 5. The percent of each county in the Falls Lake Watershed, determined by GIS analysis, was used to calculate the number of pasture acres and pastured animals within the watershed. Despite the fact that hay acres can be grown for both hay and livestock production, grazed pasture acres have never been reported under the cropland category for NLEW nitrogen loss accounting, and only acres which are grazed are reported under the pasture category for NLEW nitrogen loss accounting.For 2012, counties in the Falls Lake Watershed are reporting a 32% nitrogen loss reduction from baseline, which exceeds the rule-mandated 20% goal.

[8] Line, D.E., D.L. Osmond, & W. Childres. 2016. Effectiveness of Livestock Exclusion in a Pasture of Central North Carolina. Journal of Environmental Quality. doi:10.2134/jeq2016.03.0089

Table 5. Estimated reductions in pasture land nitrogen loss from baseline (CY1997-CY2007) for CY2012, Falls Lake Watershed

County	2007 Nitrogen Loss (lbs)	2012 Nitrogen Loss (lbs)	2012 N Loss Reduction (%)
Durham	107,134	81,189	24%
Franklin	8,433	9,384	-11%
Granville	298,607	193,961	35%
Orange	293,720	170,676	42%
Person	198,832	125,725	37%
Wake	26,110	17,271	34%
Total	932,836	598,206	36%

The reduction percentages reported above result from a combination of pasture land loss, fertilization decreases, stocking rate changes, and BMP implementation. Table 6 shows how these factors have changed in the Falls Lake Watershed since the 2007 baseline.

Table 6. Pasture operation changes from baseline (CY1997-CY2007) for CY2012, Falls Lake Watershed

Factor	2007	2012	2012 % Change
Pasture Land	40,565 acres	29,816 acres	-27%
Fertilization	92 lbs N/acre	80 lbs N/acre	-13%
Stocking Rate	0.53 animal units/acre	0.56 animal units/acre	+6%
Livestock Exclusion System Implementation	30 acres*	40 acres*	+33%

**In order to ensure consistency between pasture and cropland NLEW accounting, the livestock exclusion acres reported above represent actual setback and buffer acres. The area draining through these exclusion systems is likely substantially higher.*

BMP Implementation Not Tracked by NLEW

Not all types of nutrient and sediment-reducing BMPs are tracked by NLEW such as: 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 7 identifies BMPs and tracks their implementation in the watershed since the end of the baseline period.

Table 7: Nutrient and sediment-reducing installed best management practices, Falls Lake Watershed*

BMP	UNITS	BMPs Installed (CY2006-CY2015)
Critical Area Planting	Acre	270
Composting Facility	Number	4
Diversion	Feet	18,313
Dry Stack	Number	8
Fencing (USDA programs)	Feet	57,684
Field Border	Acre	26,722
Grassed Waterway	Acre	8,654
Nutrient Management	Acre	1,209
Pasture Renovation	Acre	326
Stream Crossing	Number	1
Sod-Based Rotation	Acre	12,482
Tillage Management	Acre	19,874
Terraces	Feet	4,163
Trough or Tank	Number	62
Waste Storage Facility	Number	7

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

Looking Forward

The Falls Lake WOC will continue to report on and encourage 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.

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. Due to an extremely wet fall growing season in late 2015, the WOC expects reported wheat acre totals in CY2016 to remain low. Indications are that corn acreage will increase in CY2016 due to a price increase.

Funding is an integral part in the success of reaching and maintaining the goal through technical assistance and BMP implementation. It is also important for data collection and reporting.

The WOC recognizes several factors affecting agriculture:

- Urban encroachment
- Market Fluctuations
- 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)

In 2001, grants funded a total of two watershed technicians and a Neuse River Basin Coordinator. The technicians' primary responsibility was to assist farmers with BMP implementation. These technicians assisted existing county staff to expedite the installation of nutrient reducing BMPs in the basin. On June 30, 2015 the last technician funding was expended, and technician funding is no longer eligible for grant awards by funding entities in the state. Therefore, less technical assistance for BMP implementation is available. Ongoing responsibility for conservation practice planning and installation now depends on local staff that also have other duties.

At the present time there is also no funding for a basin coordinator. Part of the responsibilities of the technicians and basin coordinator was to assist with the reporting requirements for the Falls Lake and Neuse Agriculture Rules. In addition to his other duties, an employee within the NCSA&CS Division of Soil and Water Conservation has been assigned the data collection, compilation and reporting duties for the Agriculture Rules for all existing Nutrient Sensitive Waters Strategies.

Farmers and agency staff personnel with other responsibilities serve on the LACs in a voluntary capacity. Without funding for technicians, the annual local progress reports fall on the LACs without local technical assistance to compile the data for the annual reports. As a result, training of new Soil and Water Conservation District staff and LAC members regarding rule requirements and reporting is ongoing.

Now that watershed technician funding has been eliminated, a more centralized approach to data collection and verification is necessary. This evolving approach will involve GIS analysis and more streamlined FSA acreage documentation. The LACs will be trained to handle the new workload to the best of their ability.

Because district staff has neither the time nor financial resources to synthesize county level data, this centralized approach will come at the expense of local knowledge. Annual agricultural reporting is required by the rules; therefore continued funding for the Division's remaining position is essential for compliance.

Previously, funding was available for research on conservation practice effectiveness, realistic yields, and nitrogen use efficiencies. Due to eligibility changes and other funding constraints, it is unlikely that new data will be developed. Prior funding sources for such research, which provided much of the scientific information on which NLEW was based, are no longer available. Should new funding be made available, additional North Carolina-specific research information could be incorporated into future NLEW updates.

Phosphorus accounting and reporting will continue to address qualitative factors and evaluate trends in agricultural phosphorus loss annually. Periodic land use surveys with associated use of PLAT are needed every five years, but it is unlikely that funding will be available for this activity. Additionally, understanding of agricultural phosphorus management could be improved through in-stream monitoring contingent upon the availability of funding and staff resources.

Members of the Falls and Jordan Lake WOCs have been working with DWR on issues regarding nutrient offsets that arise from trades involving agricultural land. Also, the WOC feels that additional research is needed on accounting procedures for pasture operations, and supports such research being conducted. Additionally, should readily accessible information become available on biosolids applications to agricultural acres in the watershed, the WOC will consider whether separate accounting for those applications of nutrients is feasible and appropriate.

Financial constraints will affect future reporting:

- The Falls Lake Watershed has lost all funding for watershed technicians. LACs are being asked to take on a more active role in the data collection and synthesis that these positions conducted previously. It should be noted that farmers and agency staff personnel with other responsibilities serve on the LACs in a voluntary capacity.
- The Neuse/Tar-Pam Basin Coordinator position is no longer funded, and the Division of Soil and Water Conservation has had to restructure current staff workloads to ensure that Falls Lake reporting can be completed. Therefore, less time is available to support local efforts to do the reporting and assist with BMP implementation and outreach.
- Periodic land use surveys critical to understanding watershed agricultural activities are contingent upon future funding.

The Falls Lake WOC will continue to monitor and evaluate crop trends. The current shift to and from crops with higher nitrogen requirements may continue to influence the yearly reduction. Significant progress has been made in agricultural nitrogen loss reduction, and the agricultural community is achieving its 20% phase I reduction goal. However, the measurable effects of these BMPs on overall in-stream nitrogen reduction may take years to develop due to the nature of non-point source pollution. Nitrogen reduction values presented in this annual summary of agricultural reductions reflect "edge-of-management unit" calculations

that contribute to achieving the 20% phase I nitrogen loss reduction goal. Significant quantities of agricultural BMPs have been installed since the adoption and implementation of the nutrient management strategy, and agriculture continues to do its part towards achieving the overall nutrient reduction goals of Falls Lake.