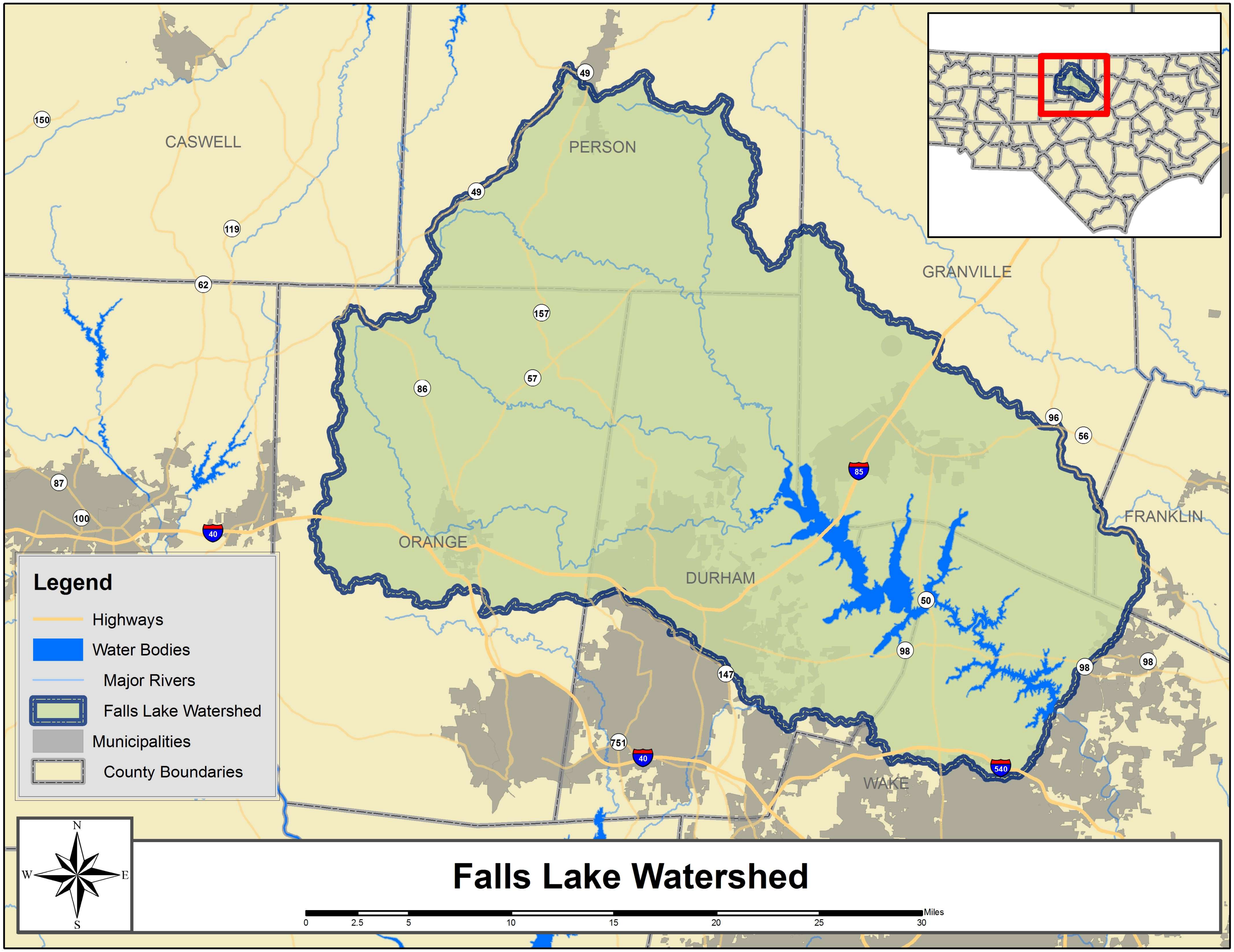
NCDA&CS

2021 Annual Progress Report (Crop Year 2020) on Agricultural Operations' Stage 1 Reductions for the Falls Lake Agriculture Rule (15A NCAC 02B .0280)

A Report to the Division of Water Resources from the Falls Lake Watershed Oversight Committee: Crop Year 2020

Date approved by Falls Lake Watershed Oversight Committee: 12/1/2021
Date submitted to NC Division of Water Resources: 12/2/2021



CASWELL
PERSON
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ORANGE
DURHAM
FRANKLIN
WAKE
Legend
Highways
Water Bodies
Major Rivers
Falls Lake Watershed
Municipalities
County Boundaries
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Falls Lake Watershed
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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, 2020. The Falls Lake WOC received and approved CY2020 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 CY2020, agriculture collectively exceeded its 20% Stage I nitrogen reduction goal for cropland and pastureland, with a 74% cropland nitrogen reduction and 42% pastureland nitrogen reduction compared to the 2006 baseline. All six counties exceeded the mandated 20% reduction goal this year.

Since the baseline, reductions in nitrogen loss 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. In CY2020, reported cropland acres in the watershed decreased by 30,803 acres from baseline acreage. It is assumed that some of the lost agricultural land was converted to development. Phosphorus qualitative indicators for CY2020 demonstrate that there is no net increased risk of phosphorus loss, with a 20% and 33% decrease in animal waste phosphorus production and tobacco acreage, respectively, and a 47% increase in cropland conversion to grass and trees since the 2006 baseline.

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

[1] The 2020 crop year began in October 2019 and ended in September 2020.

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% nitrogen 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 address non-point source pollution in agriculture, urban stormwater, and riparian buffer protection. The management strategy was modeled after similar nutrient strategies for the Neuse River, Tar-Pamlico River, and Jordan Lake.

All county Local Advisory Committees (LAC) submitted their ninth annual reports to the WOC in December 2021. Collectively, agriculture in the six counties is meeting the cropland nitrogen loss reduction goal, with a 74% reduction. Qualitative indicators for phosphorus suggest there is no increased risk of phosphorus loss from agriculture in the watershed. Pasture nitrogen loss accounting relies on USDA-NASS data which is gathered via the Census of Agriculture every five years. For CY2017 the six Falls Lake counties reported a 42% reduction in pastureland nitrogen loss compared to the 2006 baseline. This reduction exceeds the rule-mandated 20% goal.

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 the Nitrogen Loss Estimation Worksheet (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.

Over time NLEW has been updated to incorporate updated realistic yield expectations, nitrogen use efficiencies, and soil management groups. In 2015 a new web-based version of NLEW (v6.0) was created on NC Department of Agriculture and Consumer Services servers which corrected user interface bugs and allowed more accurate reporting of aggregate nitrogen loss.

Nitrogen Reduction from Cropland from 2006 Baseline for CY2020

All counties submitted their ninth progress reports to the WOC in December 2021. In CY2020 agriculture achieved a 74% reduction in nitrogen loss from cropland compared to the average 2006 baseline. Figure 1 shows annual loss percent reductions per year since CY2011, calculated with the two different versions of NLEW, and Table 1 lists each county's baseline, CY2019 and CY2020 nitrogen (lbs/yr) loss values from cropland, along with nitrogen loss percent reductions from the baseline in CY2019 and CY2020.

Figure 1. Collective Cropland Nitrogen Loss Reduction Percent 2011 to 2020, Falls Lake Watershed.

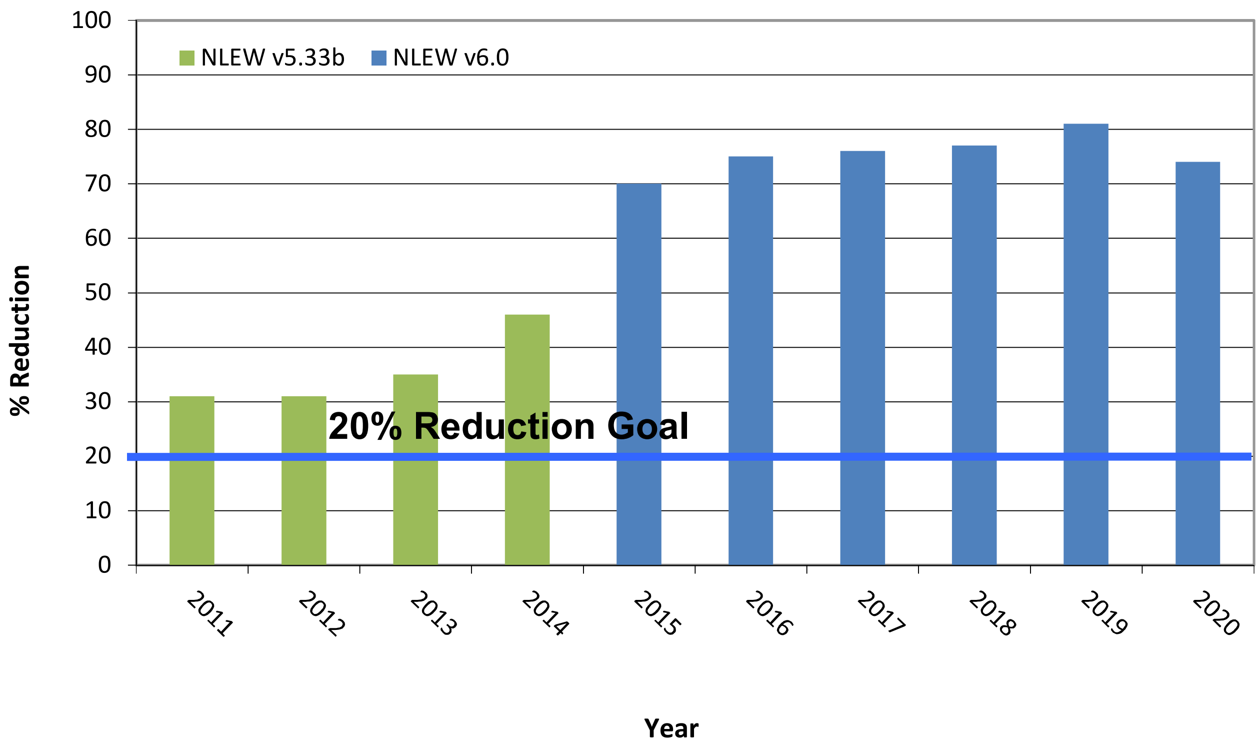


Table 1. Estimated reductions in agricultural cropland nitrogen loss from baseline (CY2006) for CY2019 and CY2020, Falls Lake Watershed

County	Baseline N Loss (lb)	CY2019 N Loss (lb) §	CY2019 N Reduction (%)	CY2020 N Loss (lb) §	CY2020 N Reduction (%)
Durham	146,090	33,200¤	77%	36,470¤	75%
Franklin	11,772	3,317	72%	4,658	60%
Granville	127,704	35,648	72%	46,313	64%
Orange	347,402	70,078	80%	85,586	75%
Person	484,123	53,223	89%	103,721	79%
Wake	52,405	26,431	50%	30,978	41%
Total	1,169,495	221,897	81%	307,726	74%

§ *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.*
¤ *This number may include some buffer acres on formerly agricultural land which has been converted to other uses (see page 6).*

Notably, three of the six counties are currently reporting a greater than 70% nitrogen loss reduction from baseline. In CY2020, Orange and Person Counties lost nearly 43% of their corn acres and over 50% of their soybean acres from baseline. All counties experienced over 50% reduction of tobacco acres from baseline values. Granville lost almost 62% of soybean acres and 16% of wheat acres. Some of these losses can be attributed to permanent loss of agricultural land to development in addition to changing crop rotations. 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. Still others may simply be idle and not receiving any fertilizer application, though it is possible that idle acres could come back into production in the future.

It is important to note that small number of agricultural acres in Durham, Franklin, and Wake Counties tends to result in a magnified effect of year-to-year crop shifts on aggregate nitrogen loss reduction in those counties. Overall, the Falls Lake Watershed is reporting a cropland nitrogen loss reduction of 74% for CY2020.

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.

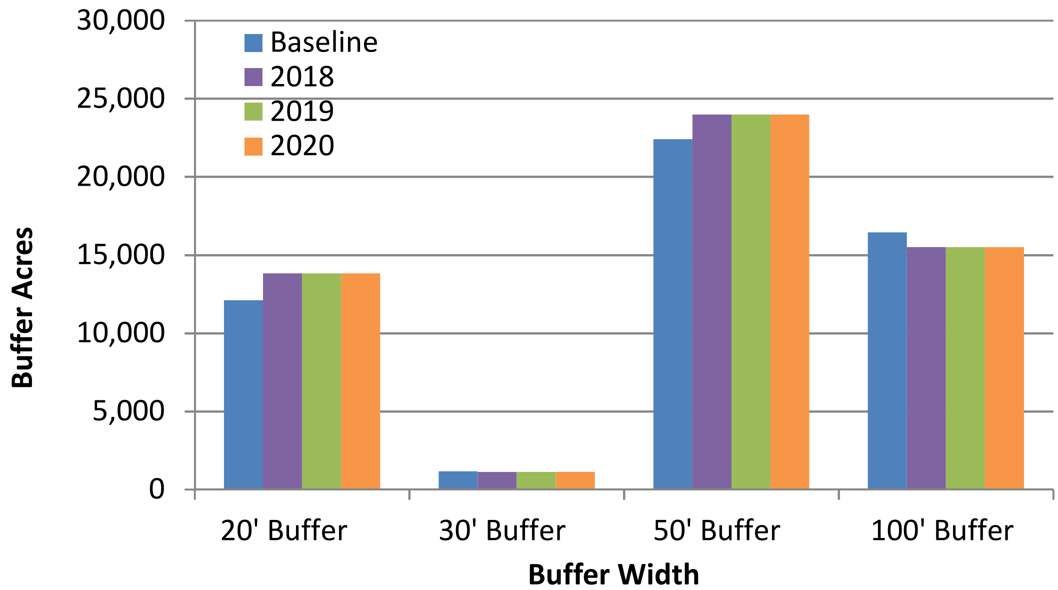
Table 2. Buffer Width Options and Nitrogen Reduction Efficiencies in NLEW

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

An accurate reassessment of active agricultural land and remaining buffer systems is needed due to the rate at which urbanizing counties have lost agricultural land. This reduction in agricultural acreage also has implications for the other counties in the watershed which do not have local staff capacity to perform a new agricultural land inventory. An interim adjustment of Durham’s BMP acre totals based on DEQ reports[2] has led to a reduction of 20 ft. buffers by 755 acres, 30 ft. buffers by 683 acres, 50 ft. buffers by 2,122 acres, and 100 ft. buffers by 4,015 acres. These adjusted totals have increased the accuracy of nitrogen loss calculations. Figure 2 illustrates the amount of buffers on cropland in the baseline (2006), CY2018, CY2019, and CY2020.

[2] Osmond, D. L., and K. Neas. "Delineating agriculture in the Neuse River Basin." Final report to NCDENR, Division of Water Quality for USEPA 319 program (2011).

Figure 2. Nitrogen Reducing Buffers Installed on Croplands from CY2018 through CY2020, compared to Baseline (CY2006), Falls Lake Watershed*



**Some of these buffers may be on land that is now in new development and therefore no longer buffering active agricultural operations.*

BMP data is collected from state and federal cost share program active contracts, and in some cases BMPs that were installed without cost share funding. While there is some variability in the data reported, LACs are reporting the best available information. As additional data is collected, the LACs will review the sources and update their methodology for reporting if warranted.

Reported riparian buffer acre estimates do not take into account the entire drainage area treated by buffers in the piedmont, which is generally 5 to 10 times higher than the actual acres of the buffer shown in Figure 2.[3] Riparian buffers have many important functions beyond being effective in reducing nitrogen. 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, buffers sequester phosphorus and sediment as they move through the riparian zone and provide other critically important functions such as wildlife habitat and stream shading.[5]

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[3] 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.

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

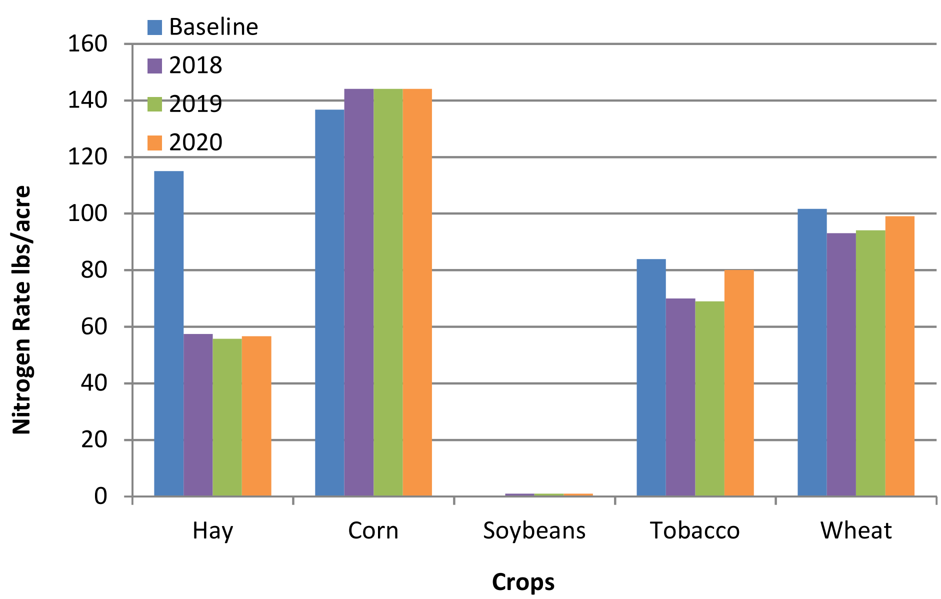
[5] Spruill, T.B., 2004, Effectiveness of riparian buffers in controlling ground-water discharge of nitrate to streams in selected hydrogeologic settings of the North Carolina Coastal Plain, Water Science and Technology 49:3, 63-70.

Fertilization Management

Since baseline, reduced nitrogen application rates have resulted from improved agronomic decision making, economic conditions, and fluctuating farm incomes. Commodity prices and low profit margins have 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 fescue hay are 58 pounds/acre lower than during the baseline. Nitrogen rates on tobacco acres increased 11 pounds/acre from CY2019 application rates. Corn, soybeans, and wheat nitrogen rates remained relatively stable (less than 5 pounds/acre fluctuations) between CY2019 and CY2020. Fertilization rates are revisited annually by county local advisory committees using data from farmers, commercial applicators and state and federal agencies' professional estimates.

Agriculture in the six counties within the Falls Lake watershed is focused primarily on pasture-based systems, with pasture ranging from 29-64% 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 under-fertilized in the Falls Lake Watershed.[6]

Figure 3. Average Annual Nitrogen Fertilization Rate (lb/ac) on Cropland from CY2018 through CY2020, compared to Baseline (CY2006), Falls Lake Watershed



[6] Osmond, D. L., and K. Neas. "Delineating agriculture in the Neuse River Basin." Final report to NCDENR, Division of Water Quality for USEPA 319 program (2011).

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 WOC anticipates that the basin will see additional crop shifts in the upcoming year based on changing commodity prices and weather.

Between CY2019 and CY2020, in total, wheat increased by almost 2000 acres, corn increased by 440 acres, and hay increased by over 800 acres. Soybean acres decreased by nearly 200 acres and tobacco acres by over 300. Wheat acres increased by over 1,100 acres in Person county alone. Person also experienced gains in corn (288) and soybean (238) acreage. Orange noted an increase in hay (432), corn (120), and wheat (335) acres and Granville experienced a 256-acre increase in hay acreage. Moderate increases were seen for hay, corn, and wheat in Durham, Franklin, and Wake counties. The wheat acreage increase seen in CY2020 is likely in part due to improved agricultural conditions from those in CY2019. A mix of rain events and dry days in October 2019 gave farmers greater opportunity to harvest summer crops and plant winter crops including wheat[7]. Although 2020 was the second wettest year on record dating back to 1895, the winter of 2019/20 was abnormally dry with unseasonably warm conditions in February and March, enabling smoother harvest of winter crops and activating an earlier growing season[8]. Some of the reductions seen in CY2020 can be explained by regular crop rotations which are necessary to minimize the risk of disease from year to year. A host of factors from individual choice to global markets determine crop selection. Figure 4 shows crop acres and shifts for CY2020 compared to the baseline. The total reported acres of all major crops decreased by nearly 31,000 acres in the watershed since baseline. None of the hay acres reported in Figure 4 are grazed by livestock.

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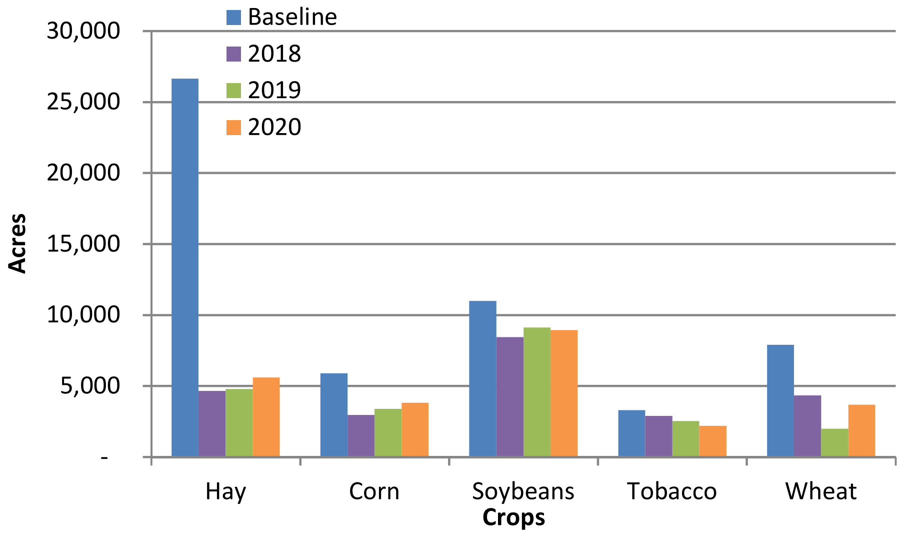
[7]Davis, C. 2019. The Heat Backed Off and Rain Picked Up in October. Prepared by North Carolina State Climate Office for the Climate Blog, Climate Summary. https://climate.ncsu.edu/blog/2019/11/the-heat-backed-off-and-rain-picked-up-in-october/

[8] Davis, C. and K. Dello. 2021. An Extreme, Unusual 2020: the Weather Year in Review. Prepared by North Carolina State Climate Office for the Climate Blog, Climate Summary. https://climate.ncsu.edu/blog/2021/01/an-extreme-unusual-2020-the-weather-year-in-review/

Figure 4. Reported Acreage of Major Crops from CY2018 through CY2020, compared to Baseline (CY2006), Falls Lake Watershed



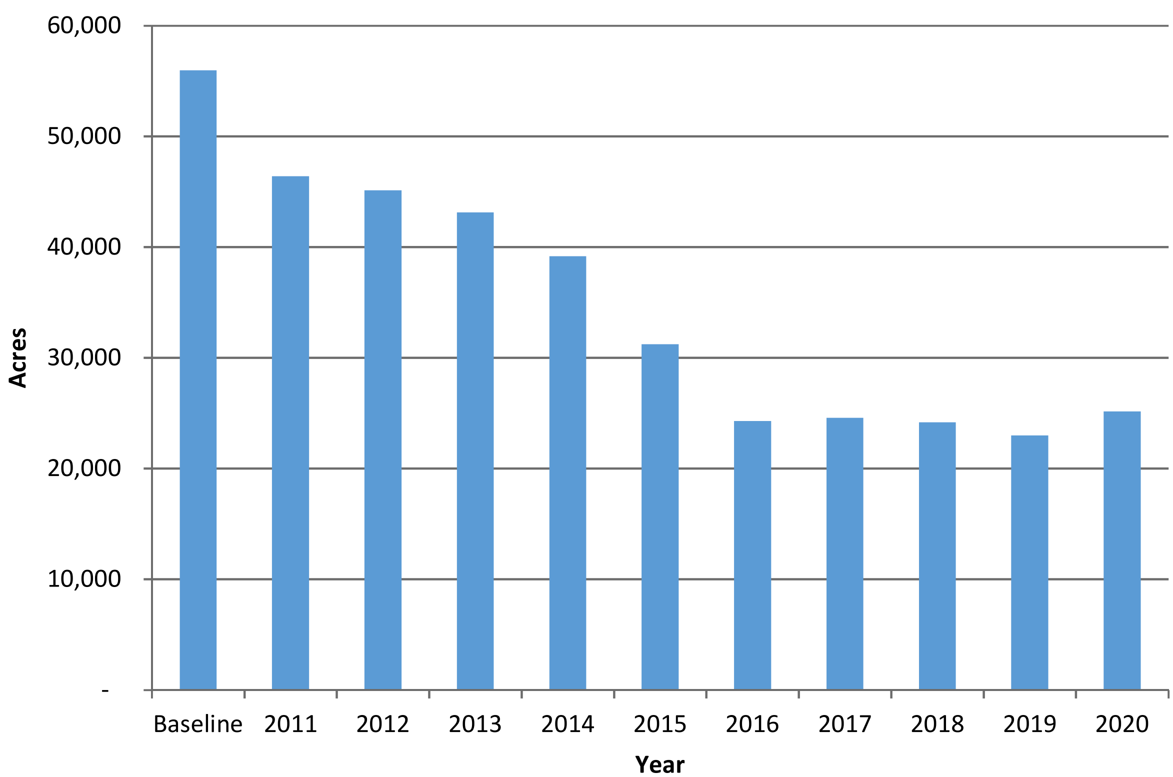
Land Use Change to Development and Cropland Conversion

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.

As shown in Figure 5, it is estimated that since the 2006 baseline there has been a decrease in crop production of 30,803 reported acres (55% of total reported cropland in baseline). An estimated 13% of agricultural land (cropland and pasture) loss has been permanently converted to development, although an accurate reassessment of active agricultural land and remaining buffer systems is needed due to the rate at which urbanizing counties have lost agricultural land. Through state and federal cost share programs, 2,249 cropland acres (7% of cropland loss) were converted to grass or trees since baseline. The remaining cropland reduction, which includes 10,574 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), 2011-2020



Phosphorus Indicators for CY2020

The Phosphorus Technical Assistance Committee (PTAC) was created to establish a phosphorus accounting method for agriculture in the Tar-Pamlico River Basin. In 2005, the PTAC 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 [baseline year] 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. In 2010, the PTAC reconvened to make minor revisions for the tool's use in Falls Lake Watershed, all of which were approved by the Water Quality Committee of the EMC. 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 for baseline (CY2006), CY2018, CY2019, and CY2020.

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	CY2018	CY2019	CY2020	% change '06-'20	P Loss Risk +/-
Reported Cropland (annual)	acres	FSA, LAC	55,969	24,162	22,978	25,166	-55%	-
Cropland conversion to Grass & Trees (cumulative)	acres	USDA-NRCS & NCACSP	1,527	2,114	2,214	2,249	+47%	-
Conservation tillage (active contract)	acres	USDA-NRCS & NCACSP	26,787	19,852	20,216	3,017†	-89%	- §
Vegetated buffers (cumulative)	acres	USDA-NRCS & NCACSP	52,139	54,421 ¤	54,421 ¤	54,424¤	+4% ¤	-
Unfertilized Cover Crop (annual)	acres	LAC	0	2,088	859	1,105	+1,105%‡	N/A
Tobacco (annual)	acres	FSA, LAC	3,288	2,822	2,537	2,198	-33%	-
Animal waste P (annual)	lbs of P/ yr	NC Ag Statistics	586,612	455,057	464,922*	470,945	-20%	-
Soil test P median (annual)	P Index	NCDA&CS	77	62	70	77	0%	-

† *Conservation tillage is being practiced on additional acres, but this number only reflects estimated acres under active cost share contracts from CY 2011 to CY2020.*

§ *Overall contracted conservation tillage acres are notably lower than during the 2006 baseline, but this is due primarily to an overall reduction in agricultural acres. The practice has been widely adopted for corn and the WOC believes that this adoption has resulted in an overall reduction of P loss risk for this category.*

¤*This number may include some buffer acres on formerly agricultural land which has been converted to other uses (see page 6).*

‡*The percent change for unfertilized cover crop acres is assumed to have increased from 1 due to the problem with calculating a percentage difference from zero.*

**Animal Waste P was adjusted for CY2019 based on updated data from USDA NASS since this value was reported.*

Most of the parameters in Table 3 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:

- Thirty-three percent reduction of tobacco acreage from baseline;
- Twenty percent decrease in Animal waste P from livestock and poultry from baseline; and
- Cropland conversion to other uses.

Based on field office reports, conservation tillage acres remain high even after contracts expire due to farmer satisfaction with the practice after initial implementation. Despite the reduction in reported tillage acres, and because some farmers have adopted the use of conservation tillage without cost share assistance, 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 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 but was approximately 20% higher than baseline in CY2019 and more than double the baseline sample numbers in CY2020 (116% increase). 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.

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. <u>Annual Qualitative Accounting:</u> 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 a 2005 PTAC report that added tobacco acres and removed water control structures.
2. <u>Phosphorus Loss Assessment Tool (PLAT):</u> 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. <u>Improved understanding of agricultural phosphorus management through studies using in-stream monitoring</u>: 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 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

Pasture nitrogen loss is also calculated using NLEW and is based on the total number of pasture acres, pastured livestock, and implemented livestock exclusion systems in the watershed. Pasture acres and pastured livestock numbers are gathered from USDA-NASS data which is collected for the Census of Agriculture every five years. Because of this the next pasture-based nitrogen loss calculation will be included in a future report when the 2022 Census of Agriculture is published. In CY2017 counties in the Falls Lake Watershed reported a 42% nitrogen loss reduction from baseline, which exceeds the rule-mandated 20% goal. Current pastureland nitrogen loss reductions are shown in Table 4 for CY2012 and CY2017.

Table 4. Estimated reductions in agricultural (pastureland) nitrogen loss from baseline (CY2007) for CY2012 and CY2017, Falls Lake Watershed*

County	Baseline N Loss (lbs)	CY2012 N Loss (lbs)	CY2012 N Reduction (%)	CY2017 N Loss (lbs)	CY2017 N Reduction (%)
Durham	55,564	41,891	25%	36,348	35%
Franklin	1,600	1,776	-11%	1,538	4%
Granville	104,474	72,371	31%	59,288	43%
Orange	47,689	24,861	48%	23,864	50%
Person	50,088	30,824	38%	29,114	42%
Wake	5,747	3,689	36%	3,795	34%
Total	**265,162**	**175,411**	**34%**	**153,947**	**42%**

**The reduction percentages reported above result from a combination of pastureland loss, fertilization decreases, stocking rate changes, and BMP implementation.*

For more information about pastureland nitrogen loss reductions in the watershed refer to the CY2018 Progress Report.

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 5 identifies BMPs and tracks their implementation in the watershed since the end of the baseline period. Table 6 indicates the total number of BMPs not accounted for in NLEW, which are under active contract (implemented from CY2011 to CY2020).

Table 5. Nutrient-Reducing Best Management Practices Not Accounted for in NLEW, Baseline to CY2020, Falls Lake Watershed*

BMP	Units	2006 - 2018	2019	2020
Critical Area Planting	Acre	711	711	712
Composting Facility	Number	8	10	11
Diversion	Feet	29,061	29,061	29,460
Dry Stack	Number	8	8	8
Fencing (USDA programs)	Feet	85,510	85,510	85,510
Field Border	Acre	27,412	27,412	27,415
Grassed Waterway	Acre	8,675	8,676	8,680
Nutrient Management Plan	Acre	1,577	1,576	1,577
Pasture Renovation	Acre	326	326	326
Stream Crossing	Number	3	4	6
Sod-Based Rotation	Acre	16,777	18,326	20,543
Tillage Management	Acre	20,553	21,029	21,294
Terraces	Feet	4,163	4,163	4,163
Trough or Tank	Number	97	99	104
Waste Storage Facility	Number	9	10	10

** Cumulative data quantified by adding BMPs implemented with State and Federal cost share program funding each Crop Year to cumulative totals reported the previous Crop Year. Additional BMPs may exist in the watershed as practices may be installed by farmers without cost share assistance.*

Table 6. Nutrient-Reducing Best Management Practices Not Accounted in NLEW installed from CY2011 to CY2020, Falls Lake Watershed*

BMP	Units	BMPs Installed (CY2011-CY2020)
Critical Area Planting	Acre	710
Composting Facility	Number	10
Diversion	Feet	15,083
Dry Stack	Number	3
Fencing (USDA programs)	Feet	52,271
Field Border	Acre	764
Grassed Waterway	Acre	179
Nutrient Management Plan	Acre	1,179
Stream Crossing	Number	5
Sod-Based Rotation	Acre	13,838
Tillage Management	Acre	3,017
Terraces	Feet	700
Trough or Tank	Number	89
Waste Storage Facility	Number	5

**Values represent active contracts in State and Federal cost share programs from CY2011 – CY2020 and were quantified by subtracting CY2020 cumulative totals from CY2011 cumulative totals. 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 by farmers without cost share assistance.*

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.

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)

Funding

Ongoing agriculture rule reporting has incorporated data processing efficiencies and improvements in recent years. NLEW upgrades have allowed LAC members to more actively participate in the compilation of data and analysis of nitrogen loss trends, and the Division of Soil and Water Conservation's contracting system has helped optimize BMP documentation efforts.

In CY2020, soil and water conservation districts spent almost $153,000 through the Agriculture Cost Share Program for nutrient-reducing BMP implementation in the Falls Lake Watershed, and the Natural Resources Conservation Service spent almost $128,000 through the Environmental Quality Incentives Program for BMP implementation in the counties of the Falls Lake Watershed. Funds are also expended for installation of these practices by local farmers and landowners either through participation in these cost share programs, or by installing practices at their own cost. Participation by so many members of the local agricultural community demonstrates a commitment toward achieving the nutrient strategy's long-term goals.

The EPA 319(h) grant program, which is administered by the Department of Environmental Quality, awards competitive grant funds for implementation of approved management programs for all types of nonpoint sources. Grant funds from the 319(h) program can be used to supplement technical assistance, match cost share funding, and support BMP implementation. From 2012 through 2015 an EPA 319(h) grant valued at $131,563 supported BMP implementation on equine operations in the Falls Lake Watershed, and from 2016 through 2017 an EPA 319(h) grant valued at $107,080 supported livestock exclusion system implementation in the Falls Lake and Jordan Lake Watersheds. The Division of Soil and Water Conservation, funded through an EPA 319(h) grant, expends approximately $50,000 on agricultural reporting staff support annually.

Funding is an integral part in the success of reaching and maintaining the goal through technical assistance and BMP implementation in addition to annual data collection and reporting. In 2001, grants from several sources funded a total of two watershed technicians and a Neuse Basin Coordinator to assist farmers with nutrient reducing BMP implementation in the basin and to complete annual reporting requirements. 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 with other duties. Budget changes at the USDA have also necessitated a statewide restructuring of North Carolina NRCS field staff, and these changes led to a reduction in federally funded technical capacity at the local level. In addition to other duties, the Nonpoint Source Planning Coordinator within the NCDA&CS Division of Soil and Water Conservation funded by EPA 319(h) funds has been assigned the data collection, compilation and reporting duties for the Agriculture Rules for all existing Nutrient Sensitive Waters Strategies.

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 not currently being conducted. These surveys are contingent upon future funding.

Now that watershed technician and coordinator funding has been eliminated, a more centralized approach to data collection and verification is necessary. This evolving approach may include developing additional GIS analysis tools and streamlining FSA acreage documentation. New tools will be vetted by the WOC and may be incorporated into the agriculture rule accounting methodology. As methods change, LACs will be trained to handle the changing workloads to the best of their ability. Because most district staff have neither the time nor financial resources to synthesize county level data, centralized collection approaches will come at the expense of local knowledge. Annual agricultural reporting is required by the rules; therefore, continued funding for the DSWC Nonpoint Source Planning Coordinator position is essential for compliance.

Previously, funding was also 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 will be incorporated into future NLEW updates. The WOC also sees the need for additional research 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.

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.

Lastly, members of the Falls Lake WOC will continue working with DWR on issues regarding nutrient offsets that arise from trades involving agricultural land.

Conclusion

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 for cropland and pastureland. 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 fulfill its obligations toward achieving the overall nutrient reduction goals for Falls Lake.