ATTACHMENT 16

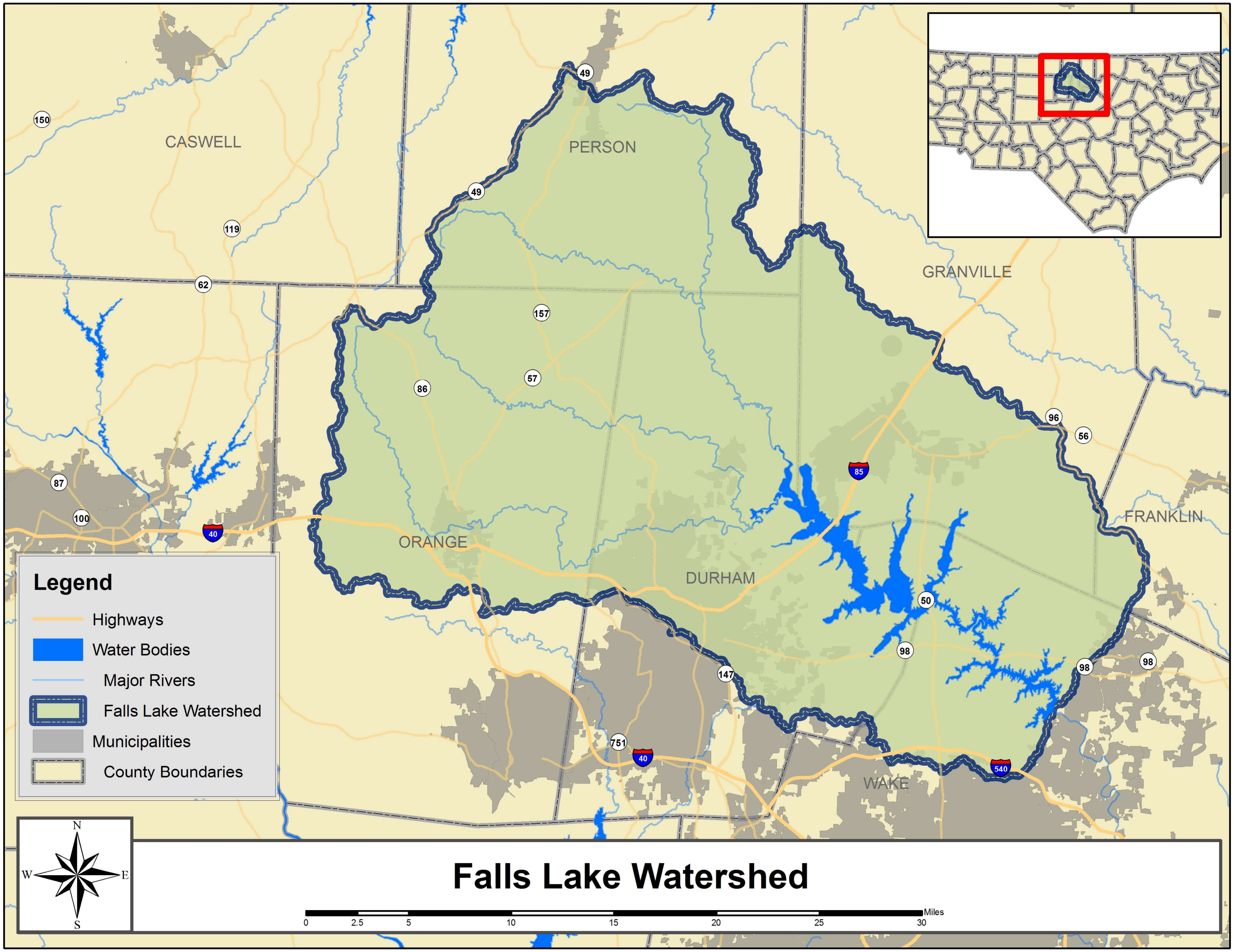
NCDA&CS

2023 Annual Progress Report (Crop Year 2022) on Agricultural Operations' Stage I and Stage II 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 2022

Date approved by Falls Lake Watershed Oversight Committee: 1/3/2024
Date submitted to NC Division of Water Resources: 1/17/2024

ATTACHMENT 16



Summary

This report provides the annual progress report of collective progress made by the agricultural community to reduce nutrient losses toward compliance with Stage I and Stage II of the Falls Lake Agriculture rule, a component of the Falls Reservoir Water Supply Nutrient Strategy. 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, 2022. To produce this report, Division of Soil and Water Conservation staff received, processed and compiled baseline and CY2022 reports from agricultural staff in six counties, for the WOC's review and approval. Agriculture has been successfully decreasing nutrient losses in the Falls Lake watershed since implementation of the Falls Reservoir Water Supply Nutrient Strategy. In CY2022, agriculture collectively exceeded its 20% Stage I and 40% Stage II nitrogen reduction goals for cropland, with a 66% cropland nitrogen reduction. Pastureland nitrogen reduction was last calculated in CY2017 given available data. In CY2017 agriculture achieved a 42% nitrogen reduction on pastureland compared to the 2006 baseline exceeding its Stage I and II nitrogen reduction goals. All six counties exceeded their local 20% reduction goal set by the WOC 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

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 CY2022, reported cropland acres in the watershed decreased by 27,162 acres from baseline acreage. It is assumed that some of the lost agricultural land was converted to development or other uses. Phosphorus qualitative indicators for CY2022 demonstrate that there is no net increased risk of phosphorus loss from agricultural lands in the watershed, with a 23% decrease in animal waste phosphorus production and a 58% increase in cropland conversion to grass and trees since the 2006 baseline.

[1] The 2022 crop year began October 1, 2021 and ended September 30, 2022.

Rule Requirements and Compliance

In January 2011, the Agriculture Rule in 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's 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 from cropland and pasture sources by year 2020. Stage II sets reduction goals of 40% and 77% for nitrogen and phosphorus, respectively, by year 2035, from cropland and pasture sources in 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. Six Local Advisory Committees (LACs), previously established through the Neuse Nutrient Sensitive Waters (NSW) Management Strategy Agriculture Rule, were tasked with assisting farmers with complying with the Falls Reservoir NSW Agriculture Rule.

Falls Reservoir Nutrient Sensitive Waters (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 eleventh annual reports to the WOC in September 2023. Collectively, agriculture in the six counties is meeting the cropland nitrogen loss reduction goal, with a 66% 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. The last available census published was for CY2017. For CY2017 the six Falls Lake counties achieved a collective 42% reduction in pastureland nitrogen loss compared to the 2006 baseline. This reduction exceeds the rule-mandated Stage I nitrogen reduction goal (20%) and the Stage II goal (40%).

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 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 CY2022

All counties submitted their eleventh progress reports to the WOC in September 2023. In CY2022 agriculture achieved a 66% 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. Table 1 lists each county's baseline, CY2021 and CY2022 nitrogen (lbs/yr) loss values from cropland, along with nitrogen loss percent reductions for CY2021 and CY2022 from baseline.

Figure 1. Collective Cropland Nitrogen Loss Reduction Percent 2011 to 2022, Falls Lake Watershed

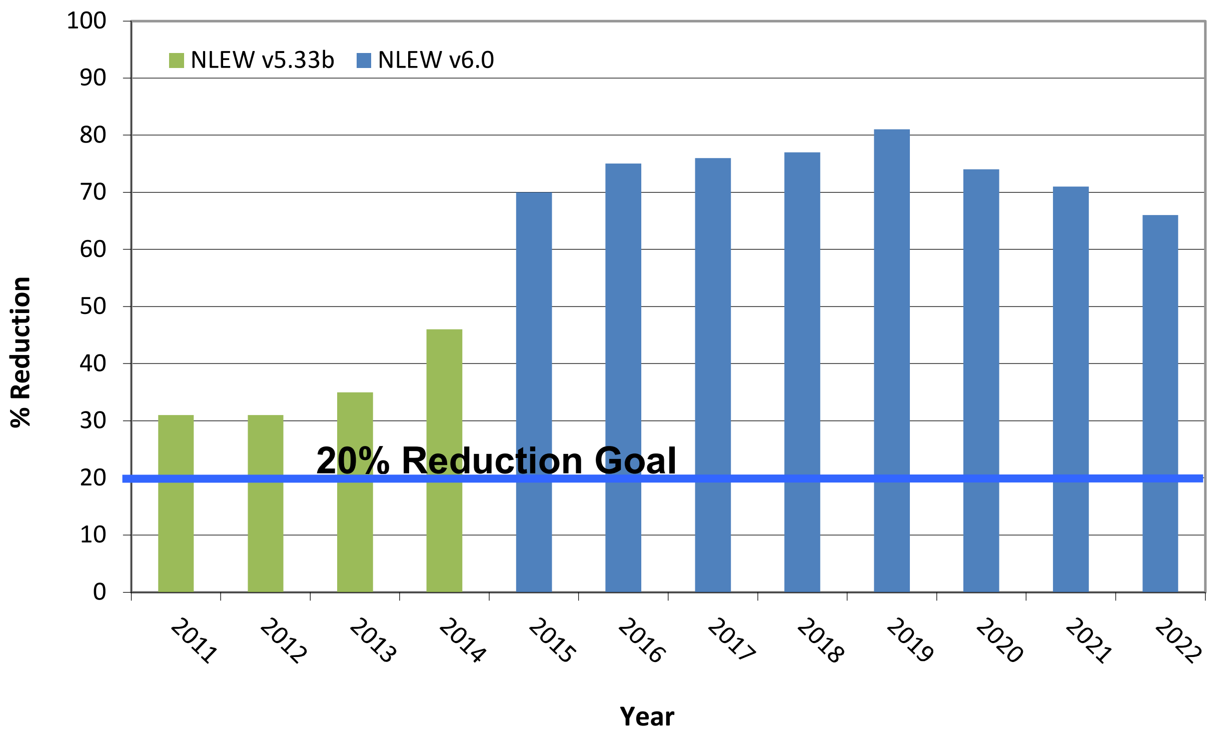


Table 1. Estimated reductions in agricultural cropland nitrogen loss from baseline (CY2006) for CY2021 and CY2022, Falls Lake Watershed

County	Baseline N Loss (lb)	CY2021 N Loss (lb) §	CY2021 N Reduction (%)	CY2022 N Loss (lb)§	CY2022 N Reduction (%)
Durham	146,090	46,105¤	68%	35,011¤	76%
Franklin	11,772	4,091	65%	4,411	63%
Granville	127,704	55,022	57%	53,666	58%
Orange	347,402	100,312	71%	78,352	77%
Person	484,123	109,283	77%	200,551	59%
Wake	52,405	26,309	50%	29,448	41%
Total	1,169,495	341,123	71%	401,438	66%

§ *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, two of the six counties, Orange and Durham, are currently reporting a greater than 70% nitrogen loss reduction from baseline. When comparing crop acreages in CY2022 to baseline, Orange county has seen a 59% reduction in corn acreage, 54% reduction in soybean acreage and 73% reduction in wheat acreage. Similarly, between CY2022 and baseline, Durham county has experienced a 92% reduction in hay acreage, 51% reduction in corn acreage, and 39% reduction in wheat acreage. Most significantly, NLEW-reportable production acres for all major crops (hay, corn, soybeans, tobacco, and wheat) have decreased since baseline. When comparing total reported CY2022 cropland production acres to baseline totals, acreage has decreased by 79% for hay, 50% for corn, 8% for soybeans, 3% for tobacco, and 28% for wheat. Some of the reported cropland acreage loss can be attributed to permanent loss of agricultural land to development. Changing crop rotations and idle land, which could return to production in the future, may account for some of the reported production acreage loss seen since baseline. It is also possible that some cropland acres are now grazed as pasture, which is 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.

It is important to note that the small amount of agricultural acreage in Durham, Franklin, and Wake Counties tends to result in a magnified effect of year-to-year crop shifts on aggregate nitrogen loss reductions in those counties. Overall, the Falls Lake Watershed is reporting a cropland nitrogen loss reduction of 66% for CY2022.

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 (ft). 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 ft. receives 20% reduction, 30 ft. receives 25% reduction, 50 ft. receives 30%, and 100 ft. 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.

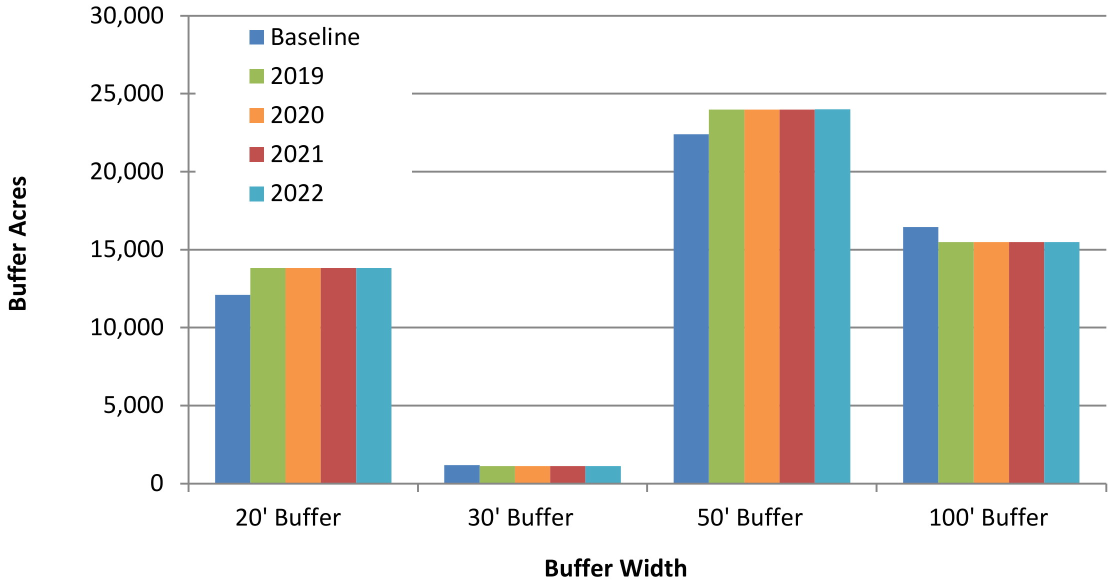
Table 2. Buffer Width Options and Nitrogen Reduction Efficiencies in NLEW

Buffer Width (feet)	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 757 acres, 30 ft. buffers by 683 acres, 50 ft. buffers by 2,123 acres, and 100 ft. buffers by 4,018 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), CY2019 through CY2022.

[2] Osmond, D. L., and K. Neas. (2011). "Delineating agriculture in the Neuse River Basin." Final report to NCDENR, Division of Water Quality for USEPA 319 program. https://content.ces.ncsu.edu/delineating-agriculture-in-the-neuse-river-basin

Figure 2. Nitrogen Reducing Buffers Installed on Croplands from CY2019 through CY2022, 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 nitrogen reduction effectiveness. 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.

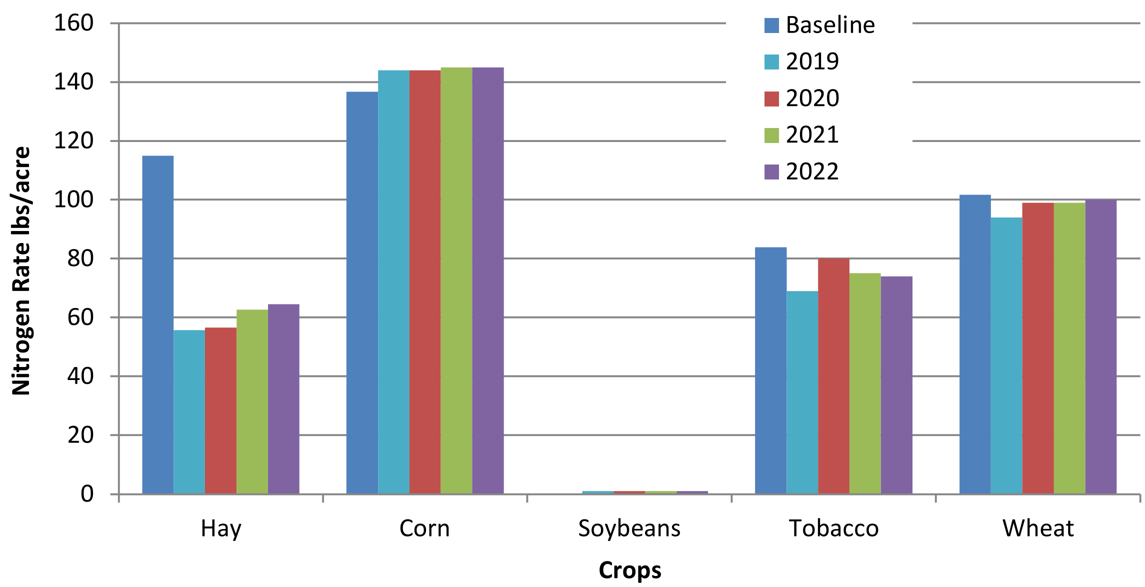
[5] Spruill, T.B., 2004, Effectiveness of riparian buffers in controlling ground-water discharge of nitrate to streams in selected hydrogeologic settings of the North Carolina Coastal Plain, Water Science and Technology 49:3, 63-70.

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 hay are 50 pounds/acre lower than during the baseline. Nitrogen rates on cotton acres increased by 8 pounds/acre from CY2021 application rates. Corn, soybeans, tobacco, and wheat nitrogen rates remained relatively stable (less than 5 pounds/acre fluctuations) between CY2021 and CY2022. 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. Available data suggest hay production acres are under-fertilized in the Falls Lake Watershed.[6]

Figure 3. Average Annual Nitrogen Fertilization Rate (lb/ac) on Cropland from CY2019 through CY2022, compared to Baseline (CY2006), Falls Lake Watershed



[6] Osmond, D. L., and K. Neas. (2011). "Delineating agriculture in the Neuse River Basin." Final report to NCDENR, Division of Water Quality for USEPA 319 program. https://content.ces.ncsu.edu/delineating-agriculture-in-the-neuse-river-basin

Cropping Shifts

Cropland acreage is calculated 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.

Fluctuating weather conditions impact annual cropping shifts by affecting farmers' ability to prepare fields for harvest and planting as well as overall crop health and yield. The winter of 2021-2022 was generally warm and dry (December, February), although the month of January was notably cool and wet.[7] Overall, 2022 concluded as a slightly drier year than normal and was among the state's top 20 warmest years on record.[8] Nevertheless, across the state precipitation varied substantially (the north and west were slightly wetter than normal, the east considerably drier) and there were frequent rapid changes from wet to dry conditions (and back again).[8]

Annual cropping shifts seen in CY2022 can also be explained by regular crop rotations, which are necessary to minimize the risk of disease from year to year. A host of other factors from individual choice to global markets can impact annual selection. Between CY2021 and CY2022, in total, hay decreased by 576 acres and corn decreased by 906 acres. Cotton, soybeans, tobacco, and wheat all increased between CY2021 and CY2022 by 105 acres, 899 acres, 510 acres, and 1,897 acres respectively. Durham, Orange, and Person lost the most hay acres (174, 290, and 174 acres respectively). Durham, Granville, and Orange experienced the largest corn acreage losses (205, 156, and 476 acres respectively). Durham, Granville, and Orange had the largest soybean increases (245, 423, and 237 acres respectively). Person experienced the largest increases in tobacco and wheat acres of all the counties (640 and 1,888 acres respectively). Wake experienced only moderate increases or decreases between CY2021 and CY2022 for all major crops. The WOC anticipates that the basin will see additional crop shifts in the upcoming year based on changing commodity prices and weather.

Figure 4 shows crop acres and shifts for CY2022 compared to the baseline. When comparing CY2022 totals to baseline, NLEW reported production acreage for all major crops (hay, corn, soybeans, tobacco, and wheat) has declined by over 27,000 acres in total since baseline. None of the hay acres reported in Figure 4 are grazed by livestock.

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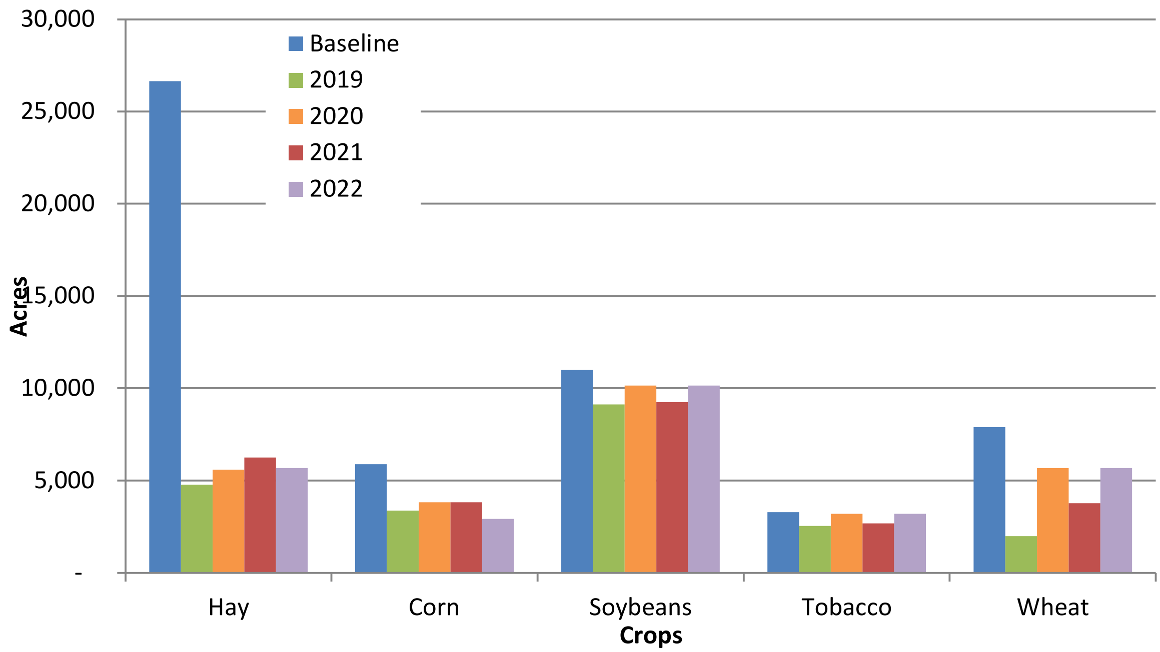
[7] Davis, C. 2022. Winter Recap 2021-22: Warm Weather Prevails, Even with a Snowy Surprise. Prepared by North Carolina State Climate Office for the Climate Blog, Climate Summary. https://climate.ncsu.edu/blog/2022/03/winter-recap-2021-22-warm-weather-prevails/

[8] Davis C, and K. Dello. 2023. The Weather Year in Review: Familiar Patterns with New Twists in 2022. https://climate.ncsu.edu/blog/2023/01/the-weather-year-in-review-familiar-patterns-with-new-twists-in-2022/

Figure 4. Reported Acreage of Major Crops from CY2019 through CY2022, compared to Baseline (CY2006), Falls Lake Watershed

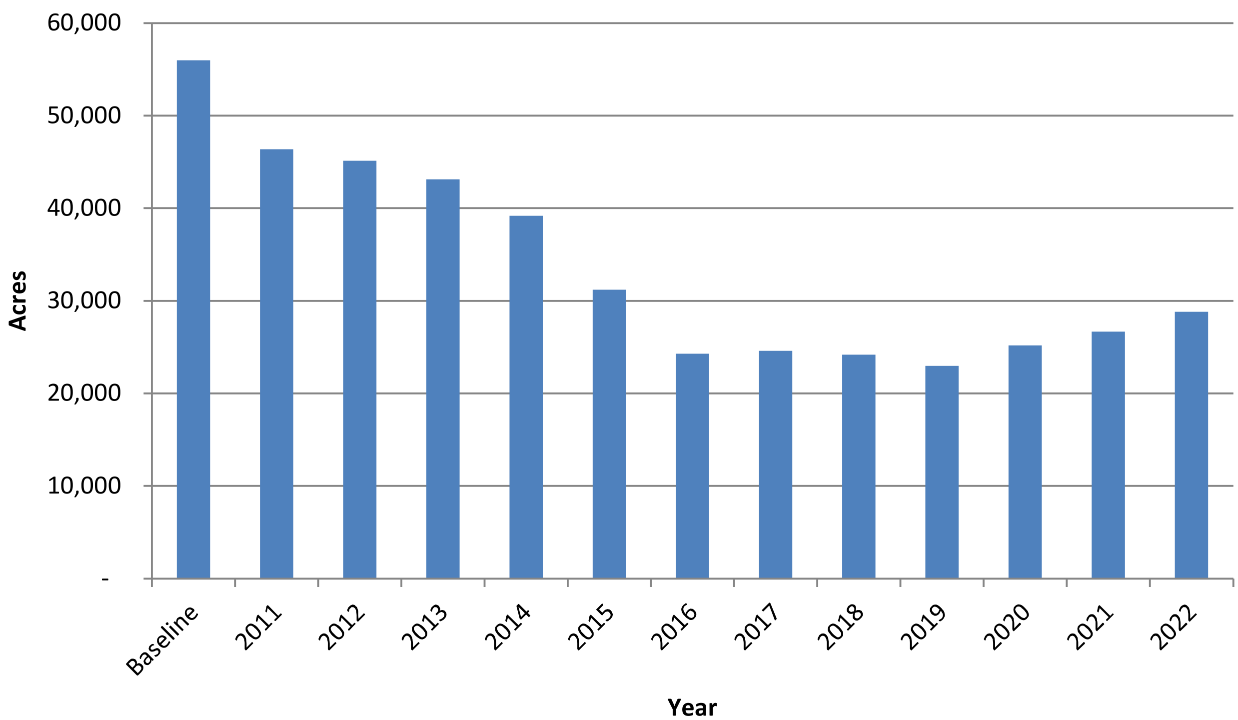


Land Use Change to Development and Cropland Conversion

The number of cropland acres fluctuates every year in the Falls Lake Watershed. Each year, some cropland is either permanently lost to development, converted to grass or trees and likely to be ultimately lost from agricultural production, or temporarily taken out of production. Idle land represents agricultural land that is currently out of production but could be brought back into production at any time. In CY2022, 28,807 NLEW-accountable crop acres were reported in the Falls Lake Watershed along with 10,192 acres of idle land.

As shown in Figure 5, it is estimated that since the 2006 baseline there has been a decrease in 27,162 acres of NLEW-accountable crops (49% of total reported cropland in baseline). Reported cropland in Figure 5 does not include idle land acreage. Based on accounting methodologies developed at the county level and best available data, between baseline and CY2015, 4,708 acres of agriculture land were estimated to have been permanently converted to development. Agriculture land acres lost to development have not continued to be tracked since CY2015 due to ongoing reporting inconsistencies between local governments and an inability to separate cropland and pastureland loss to development. An accurate reassessment of active agricultural land (cropland and pastureland) and remaining buffer systems is needed due to the rate at which urbanizing counties have lost agricultural land. Cropland conversion totals supported by state or federal cost-share funds continue to be tracked and updated annually. From baseline to CY2022, 2,410 cropland acres in the Falls Lake watershed have been converted to grass or trees.

Figure 5. Total Reported Cropland Acres in the Falls Lake Watershed, Baseline (2006), 2011-2022



Phosphorus Indicators for CY2022

The Phosphorus Technical Advisory 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 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) and CY2020 through CY2022.

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	CY2020	CY2021	CY2022	% change '06-'22	P Loss Risk +/-
Reported Cropland (annual)	acres	FSA, LAC	55,969	25,166	26,667	28,807	-49%	-
Cropland conversion to Grass & Trees (cumulative)	acres	USDA-NRCS & NCACSP	1,527	2,249	2,290	2,410	+58%	-
Conservation tillage (active contract)	acres	USDA-NRCS & NCACSP	277§	3,448†	3,448†	3,668†	+1,224%	-
Vegetated buffers (cumulative)	acres	USDA-NRCS & NCACSP	52,139	54,424¤	54,425¤	54,449¤	+4% ¤	-
Unfertilized Cover Crop (annual)	acres	LAC	0	1,105	1,651	1,626	+1,626%‡	N/A
Tobacco (annual)	acres	FSA, LAC	3,288	2,198	2,684	3,194	-3%	-
Animal waste P (annual)	lbs of P/ yr	NC Ag Statistics	586,612	470,945	465,598	454,608	-23%	-
Soil test P median (annual)	P Index	NCDA&CS	77	77	76	78	1%	+

§ *The baseline value for conservation tillage was updated to correct a calculation error in the master spreadsheet.*

† *Conservation tillage is being practiced on additional acres, but this number only reflects estimated acres under active cost share contracts approximated by a rolling ten-year window (2012 – 2022).*

¤*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.*

Most of the parameters in Table 3 indicate less risk of phosphorus loss from agricultural management units than in the baseline period. Factors significantly contributing to the reduced risk of phosphorus loss in the Falls Lake Watershed include:

- Forty-nine percent reduction in cropland from baseline;
- Twenty-three 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 implementation. Additionally, 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. Agricultural survey results indicate counties that are part of the Falls Lake watershed have a high percentage of pasture and hay land use and conservation tillage management is common, particularly in Orange, Durham, and Person counties.[9] With this reasoning, the phosphorus loss risk is reduced for that tracked parameter.

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 generated by using North Carolina Department of Agriculture and Consumer Services (NCDA&CS) soil test laboratory results from voluntary soil testing on agriculture land and the data is reported by the NCDA&CS. The number of samples collected each year varies but was approximately 16% lower in CY2022 than the number of samples used to determine the soil test phosphorus median number in baseline. 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. 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 a 2005 PTAC report that added tobacco acres and removed water control structures.
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 (1.07 lbs/ac/yr) is rated at the low end of the PLAT medium range (1.1 – 2 lbs/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.

[9] Osmond, D. L., and K. Neas. (2011). "Delineating agriculture in the Neuse River Basin." Final report to NCDENR, Division of Water Quality for USEPA 319 program. (pp. 49 – 50). https://content.ces.ncsu.edu/delineating-agriculture-in-the-neuse-river-basin

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 sub-watersheds 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. The next pasture-based nitrogen loss calculation will be included in a future report when the 2022 Census of Agriculture is published in February 2024. In CY2017 counties in the Falls Lake Watershed achieved 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.

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

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.*

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 implementation of 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 (approximated by a rolling ten-year window from CY2012 to CY2022).

Table 5. Nutrient-Reducing Best Management Practices Not Accounted for in NLEW, Baseline to CY2022, Falls Lake Watershed*

BMP	Units	2006 – 2020**	2021**	2022
Critical Area Planting	Acre	558	558	558
Composting Facility	Number	12	12	12
Diversion	Feet	30,844	31,424	32,224
Dry Stack	Number	9	9	9
Fencing (USDA programs)	Feet	85,510	85,510	85,510
Field Border	Acre	30,286	30,286	30,286
Grassed Waterway	Acre	113	115	120
Nutrient Management Plan	Acre	906	906	906
Pasture Renovation	Acre	326	326	326
Stream Crossing	Number	5	5	6
Sod-Based Rotation	Acre	17,361	17,462	17,517
Tillage Management	Acre	4,857	4,857	5,172
Terraces	Feet	4,988	4,988	4,988
Trough or Tank	Number	102	102	102
Waste Storage Facility	Number	5	5	5

**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.*

***Values are updated from previous reports to correct for spreadsheet errors.*

Table 6. Nutrient-Reducing Best Management Practices Not Accounted in NLEW installed from CY2012 to CY2022, Falls Lake Watershed*

BMP	Units	BMPs Installed (CY2012-CY2022)
Critical Area Planting	Acre	558
Composting Facility	Number	11
Diversion	Feet	15,992
Dry Stack	Number	3
Fencing (USDA programs)	Feet	52,271
Field Border	Acre	714
Grassed Waterway	Acre	60
Nutrient Management Plan	Acre	425
Pasture Renovation	Acre	0.26
Stream Crossing	Number	5
Sod-Based Rotation	Acre	15,514
Tillage Management	Acre	3,668
Terraces	Feet	700
Trough or Tank	Number	72
Waste Storage Facility	Number	5

**Values represent active contracts in State and Federal cost share programs quantified by subtracting CY2012 cumulative totals from CY2022 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 working 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 lasting reductions 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 (e.g., commodity support or environmental regulations)
- Weather (e.g., long periods of drought or rain)
- Scientific advances in agronomics (e.g., production of new types of crops or improvements in crop sustainability)
- Plant disease or pest problems (e.g., viruses or foreign pests)

Funding

Ongoing agriculture rule reporting has incorporated data processing efficiencies and improvements over time. 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 digital contracting system has helped optimize BMP documentation efforts.

In CY2022, Soil and Water Conservation Districts spent over $149,000 through the Agriculture Cost Share Program for nutrient-reducing BMP implementation in the Falls Lake Watershed. The Natural Resources Conservation Service spent over $180,000 through the Environmental Quality Incentives Program for BMP implementation in the counties lying in the Falls Lake Watershed. Funds were 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.

Sufficient funding for technical assistance and BMP implementation incentivization is indispensable for continued achievement and maintenance of agricultural nitrogen reduction and phosphorus loss risk reduction goals. Local demand for funding, to support experienced staff versed in conservation planning and cost-share program implementation in addition to supporting adoption of water-quality improving BMPs, far outstrips existing resources. Local levels of technical assistance for BMP implementation have changed since the Falls Reservoir Water Supply Nutrient Strategy Rules were adopted in 2011. As of Fiscal Year (FY) 2016, previously funded basin and watershed technicians assisting farmers with nutrient reducing BMP implementation are no longer supported by granting state entities. Concurrent budget changes at the USDA also resulted in statewide restructuring of North Carolina NRCS field staff, leading to a reduction in federally funded technical capacity at the local level. Consequently, ongoing responsibility for conservation practice planning and installation now largely depends on local Soil and Water Conservation District staff with escalating workload and capacity demands. Additionally, while two EPA 319(h) grants ($238,643 in total) were obtained between 2012 and 2017 to support livestock exclusion system implementation and BMP implementation on equine operations, more funding, through existing cost-share programs or outside grants, continues to be needed to incentivize conservation activity in the Falls Lake Watershed. In FY2023, Soil and Water Conservation Districts lying within Falls Lake Watershed requested nearly three times more Agriculture Cost Share Program funding beyond the fiscal year's allocation. Funding of state and federal cost share programs is essential for continued progress in reducing nutrient losses from agricultural land.

Funding is also necessary for continued agricultural data collection and annual reporting. With the loss of grant-supported basin and watershed technicians as of FY2016, annual data collection, compilation and reporting duties for the Falls Lake Watershed and all other basins and watersheds subject to existing NSW Management Strategies with Agriculture Rules were assigned to the NCDA&CS Division of Soil and Water Conservation's Nonpoint Source Planning Coordinator. The Division of Soil and Water Conservation expends approximately $90,000 on agricultural reporting staff support annually, using funds received through an EPA 319(h) grant administered by the Department of Environmental Quality. Annual agricultural reporting is required by the rules; therefore, continued funding for the DSWC Nonpoint Source Planning Coordinator position is essential for compliance.

Reductions in funding and staffing necessitate implementing a more centralized approach to agricultural data collection and verification for annual progress reports. This evolving approach may include developing additional GIS analysis tools, streamlining FSA acreage documentation, and training LACs on how to handle changing methods. New tools will be vetted by the WOC and may be incorporated into the agriculture rule accounting methodology. While necessary with existing funding and staffing limitations, centralizing and automating data collection and verification may come at the expense of local knowledge.

Previously, funding was available for research on conservation practice effectiveness, realistic yields, and nitrogen use efficiencies. Due to grant 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. Should readily accessible information from DEQ become available for permitted biosolids applications to agricultural acres in the watershed, including rate, nutrient content, and spatial application information, 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% Stage I and its 40% Stage II reduction goals for cropland and pastureland. However, the measurable effects of implemented 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 staged nitrogen loss reduction goals. 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.