

Request for Approval of Accounting Methods Under the Falls Agriculture Rule

Summary

The Falls agriculture rule, 15A NCAC 02B .0280, effective January 15, 2011, requires the agriculture community to collectively comply with the strategy percent reduction goals to be achieved in two stages. Stage I establishes reduction goals of 20% TN and 40% TP to be collectively achieved by agriculture by 2021. Stage II calls for reduction goals of 40% TN and 77% TP to be collectively achieved by agriculture by 2036. Stage II may also require the buffering of all cropland and buffers and exclusion on all pasture if agriculture does not achieve their Stage I goal. These reductions are relative to a 2006 baseline period. Municipal residual application operations are required under the rule to use Realistic Yield Expectation nitrogen application rates and submit annual soil test phosphorus and phosphorus application rates by the end of Stage I to the Division of Water Quality (DWQ). Success in meeting this Rule's goals will be gauged by estimating percentage changes in nitrogen loss and by evaluating broader trends in indicators of phosphorus loss from agricultural lands in the Falls watershed.

The rule requires a Watershed Oversight Committee (WOC), formed by the Director of DWQ, to develop tracking and accounting methods for nitrogen and phosphorus loss and to submit them to the Water Quality Committee of the Environmental Management Commission for approval by March 15, 2012.

The rule sets requirements for the WOC to develop separate accounting methods for cropland nitrogen, pasture nitrogen, and overall phosphorus driven by fundamental differences in accounting needs across these categories. This report summarizes the accounting methods proposed for each of these purposes and requests Water Quality Committee approval of each.

Nitrogen Accounting Method

The rule requires the WOC to develop a nitrogen accounting method that shall:

1. Quantify baseline and annual total nitrogen losses from agricultural operations in each county for the entire Falls watershed;
2. Include a means of tracking implementation of BMPs, including number, type, and area affected;
3. Include a means of estimating incremental nitrogen loss reductions from actual BMP implementation and of evaluating progress toward and maintenance of the nutrient goals from changes in BMP implementation, fertilization, individual crop acres, and agricultural land use acres; and
4. Be refined as research and technical advances allow.

The Falls watershed is located within the Neuse River basin which has its own agriculture rule, effective August 1998, as part of the nutrient management strategy to address water quality issues in the Neuse estuary. As such, agriculture in the Falls watershed has the experience of

already implementing similar agriculture requirements. Falls is also the beneficiary of a great amount of effort by a range of agency, university, and other participants over a number of years that resulted in a cropland nitrogen accounting method called the Nitrogen Loss Estimation Worksheet, or NLEW. First developed for the Neuse Basin, NLEW was then applied to the Tar-Pamlico Basin and more recently the Jordan Watershed.

NLEW can be used in its current Neuse Basin form, Version 5.33, in the Falls watershed for implementation of the Falls agricultural rule, and the Falls WOC proposes to do so. The Local Advisory Committees (LACs) in the Falls watershed will use NLEW to quantify nitrogen losses for the 2006 baseline period. Much of the agriculture nitrogen loss information for 2006 is already available for the counties in the Falls watershed through previous NLEW reporting conducted by the LACs for the annual Neuse agriculture rule progress reports to the Environmental Management Commission (EMC). As a part of the baseline calculation process, the 2006 information from previous NLEW reports for the Falls watershed counties will be updated as necessary with any previously unavailable historical data and reflect NLEW tool updates that have taken place since 2006. NLEW will also be used to quantify nitrogen losses for the most recent crop year and compared to the 2006 to form the first estimates of agriculture's progress under the rule. For each period, LACs will collect crop acreage data, estimate aggregate N application rates for each crop, tabulate cost-shared BMP acres, and enter these data into NLEW for each county. The resulting county N loss reductions will then be aggregated to produce N loss reduction estimates to date. The process will be repeated each year with the most recent crop, BMP and N fertilizer application rates.

Phosphorus Accounting Method

The rule requires the WOC to develop a phosphorus accounting method that:

1. Includes a means of tracking implementation of BMPs, including number, type and area affected;
2. Quantifies baseline values for and annual changes in factors affecting agricultural phosphorus loss as identified by the phosphorus technical advisory committee established under 15A NCAC 02B .0256(f)(2)(C). The method shall provide for periodic qualitative assessment of likely trends in agricultural phosphorus loss from the Falls watershed relative to baseline conditions;
3. May also include a scientifically valid, survey-based sampling of farms in the Falls watershed for the purpose of conducting field-scale phosphorus loss assessments and extrapolating phosphorus losses for the Falls watershed for the baseline period and at periodic intervals;
4. Shall be refined as research and technical advances allow.

These requirements reflect the process developed to address phosphorus accounting under the Tar-Pamlico agriculture rule, 15A NCAC 02B .0256. The Tar-Pamlico rule required the formation of a Phosphorus Technical Advisory Committee (PTAC). The research and work done by that Committee, presented in "Accounting Method for Tracking Relative Changes in

Agricultural Phosphorus Loading to the Tar Pamlico River” dated October 21, 2005, was utilized to develop the Phosphorus Accounting Method for agriculture in the Jordan watershed.

A similar approach is recommended for implementation of the Falls agriculture rule. The Tar-Pamlico accounting method uses a set of phosphorus loss indicators identified by the PTAC. For each of these indicators, annual values are compared to baseline values to provide indication of increase, decrease, or no change. These indicators are then reviewed collectively for a qualitative assessment of change. The indicators identified for the Tar-Pamlico Basin were the following:

- Total agricultural land acres
- Total agricultural land acres that have been converted to grass or trees
- Conservation Reserve Program and Wetland Reserve Program acres
- Conservation Tillage
- Acres affected by buffers
- Acres affected by water control structures
- Total scavenger crop acres
- Animal waste P produced, lbs P/Year
- Soil test P, weighted average, mg kg
- Soil test P, median, mg kg

The PTAC conferred in April 2010 during the Jordan WOC process to review and update the phosphorus tracking methodology for the Jordan Lake Agricultural Rule requirements. The committee recommended the following changes to the set of indicators for use in the Jordan watershed. These revisions are also recommended by the Falls WOC for the Falls watershed:

- Add tobacco acres, and
- Remove water control structures.

The Falls WOC also recommends adding tracking of the annual application of municipal biosolids applied to agriculture lands. The Jordan WOC decided to remove this element from the tracking methodology due to lack of readily accessible biosolids data in the Jordan watershed. However, given the much larger reduction needs the tracking of biosolids application takes on even greater importance in the Falls Watershed. As in Jordan, biosolids applicators in Falls currently submit paper copy annual reports containing application and site information that the North Carolina Department of Environment and Natural Resources (NCDENR) is currently not keying into a database due to limited staff resources. However, given the smaller size of the Falls watershed it may be possible to include this information if NCDENR resources can be allocated to compile historical data and enter new hard copy data for the Falls watershed, making it possible for municipal biosolids applications to be tracked as a separate component of the phosphorus accounting.

Given the key role of phosphorus in the Falls 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 and adding tobacco acreages and removing water control structures.

2. Periodic agricultural and land use and practices survey, and associated Phosphorus Loss Assessment Tool (PLAT) calculations to determine P losses and improvements from conservation practices. Contingent upon the availability of funding and staff resources, every five years a scientifically valid survey-based evaluation of agricultural fields in the Falls watershed should be conducted. The purpose of this assessment is to collect information to be used in a field-scale phosphorous loss assessment using PLAT. This information can then be extrapolated to phosphorus reductions for the Falls watershed. After the next land use and practice assessment in 2014 (funds permitting), the methodology will be assessed to determine if this approach is useful for determining progress in meeting numeric phosphorus reductions.
3. Improved understanding of agricultural phosphorus management through studies using in-stream Monitoring: Quantitative in-stream monitoring should be funded 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 will allow estimates of phosphorus loading for different management regimes and load reductions after conservation practices have been implemented.

Pasture Accounting

The rule also requires the WOC to develop accounting for pasture-based livestock operations:

- Aspects of pasture-based livestock operations that potentially affect nutrient loading and are not captured by the accounting methods described above shall be accounted for in annual reporting to the extent that advances in scientific understanding reasonably allow. Such accounting shall, at a minimum, quantify changes in the extent of livestock-related nutrient controlling BMPs. Progress may be judged based on percent change in the extent of implementation relative to percentage objectives identified in rule .0280 of this Section.

The Jordan WOC formed a pasture point system subcommittee in 2010 to revisit the accounting method developed through session law for the Tar-Pamlico agriculture rule. The subcommittee consisted of individuals representing North Carolina State University (NCSU), United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), NC Division of Soil and Water Conservation (DSWC), NC Division of Water Quality (DWQ), NC Department of Agriculture and Consumer Services (NCDA&CS), and Alamance Soil and Water Conservation District. After reviewing available data sources and existing research findings the sub-committee made certain observations and recommendations, which both the Jordan and Falls WOCs have accepted. They found that:

- While the Tar-Pamlico point system was of sound design, it was not practically implementable because it required field-scale assessment, for which human resources were not available. For the purposes of this rule, given the same resources limitations, a

county-scale approach to nitrogen loss accounting will be necessary as done with cropland NLEW accounting.

- Unlike state-based cropland statistics that are developed annually, pasture activities are tracked only by the federal Census of Agriculture conducted by USDA-National Agricultural Statistical Service every five years. This will necessarily limit pasture accounting under this rule to a 5-year cycle.
- The point system developed for the Tar-Pamlico is fundamentally sound. It assigned nitrogen “point” credit values for BMPs in lieu of percent reductions based on recognition that research data are insufficient to provide the level of confidence required for attributing percent reductions in load. Point values reflect best estimates of percent load reduction but instead bear the “point” label to connote this greater uncertainty. Research has advanced since the Tar-Pamlico system was developed but not sufficiently to depart from this approach.
- Certain refinements are needed to point assignments for specific BMPs based on additional research findings.

The Falls WOC endorses for Committee approval the following recommendations regarding a pasture point system. They are the same recommendations approved by the Water Quality Committee in July 2011 for pasture accounting under the Jordan agriculture rule:

1. Pasture accounting will be county-scale and conducted on a 5-year cycle.
2. For each county, the Census of Agriculture will be used for pasture acres and pasture livestock numbers. We will use pasture acres to determine the percentage of pasture land to which BMPs will be applied. In addition, pasture acres and livestock numbers will allow the calculation of livestock stocking density (animal units per acre), which will allow livestock intensity to be tracked.
3. The 2007 Census of Agriculture will be used to represent the baseline period. The first accounting will use the 2012 Census of Agriculture for comparison. For each county, pasture BMPs funded by state and federal cost share programs will be tracked annually and compiled every 5 years. Individual contracts will be reviewed to compile pasture acres affected by each BMP.
4. For each county for each implementation period, acreage-weighted BMP point assignments will be aggregated and compared to baseline values to yield a county point reduction estimate.
5. Pasture point values will not be combined with cropland NLEW reduction estimates given differences in the nature of these estimates. Progress for cropland and pasture will instead be tracked independently.
6. The following pasture BMPs will be used:
 - Exclusion Fencing: Exclusion fencing with a 10’ stream setback will receive 30 points.
 - Exclusion Fencing with a buffer:
 - Exclusion + 20’ buffer will receive 50 points
 - Exclusion + 30’ buffer will receive 55 points
 - Exclusion + 50’ buffer will receive 60 points
 - Exclusion + 100’ buffer will receive 65 points

These buffer credits incorporate the most recent adjustments made to NLEW cropland accounting, which reflect current research estimating restored buffer net efficiency improvements.

- Other valuable pasture BMPs approved under the Tar-Pamlico system were not unusable relative to nitrogen accounting either from a practical implementation standpoint (prorated cattle exclusion) or from a current research perspective (alternative watering systems).
- Additional BMPs may be added as supported by research and found to be accountable within this system.

Recommendations

The Falls Watershed Oversight Committee requests the Water Quality Committee's approval of the following methods as detailed in this report for use in fulfillment of the requirements of the Falls Agriculture rule:

1. Aggregate version of the Nitrogen Loss Estimation Worksheet (NLEW) for cropland nitrogen reporting.
2. Qualitative land use and agricultural practice implementation survey associated phosphorus loss assessment using PLAT is necessary on a five year cycle as is water quality research (in-stream monitoring) to document phosphorus load reductions from conservation practices. We suggest the survey be conducted every five years and in-stream monitoring start immediately, pending availability of resources.
3. Pasture Point System accounting methodology.

Next Steps & Implementation Needs

Upcoming implementation steps in compliance with the rule are as follows: LACs shall develop local nutrient control strategies for agricultural operations to meet the nitrogen and phosphorus objectives of the rule and submit them to the WOC for approval by July 2012. Over the course of the next year, LACs will collect data needed to conduct initial nitrogen and phosphorus loss accounting for cropland and pastureland for the 2006 baseline period and the most current year feasible, perform nutrient accounting, and determine the extent to which agricultural operations have achieved the Stage I nitrogen reduction objective and evaluate phosphorus loss trend indicators for the watershed, and present these findings to the Water Quality Committee by January 2013. Independent of the 2013 determination of achievement, the WOC shall subsequently provide annual NLEW and phosphorus reports to the Division. As proposed here, the WOC would provide pasture reporting every five years, with the next report following the 2014 release of the 2012 Census of Agriculture. In 2014 the WOC's annual report shall include an assessment of the practicability of producers achieving the Stage I objective by calendar year 2020, and recommendations to the Commission as deemed appropriate. In 2016 DWQ, in

consultation with the WOC, shall submit a report to the Commission gauging the extent to which reasonable progress has been achieved towards the Stage I objectives. Annual NLEW and phosphorus reporting, and 5-year pasture reporting shall continue until the Commission determines that such reporting is no longer needed to fulfill the purposes of the rule.

Funding is an integral part in adding to the success of the Fall Lake strategy. Without funding for local technicians, the annual progress reports and BMP installation responsibilities would fall on the LACs without assistance to compile data and annual reports. Farmers and agency staff personnel with other responsibilities serve on the LACs in a voluntary capacity. If funding for technician positions is not available, the LACs would have a difficult time meeting the workload requirements. Additional funding sources will also need to be identified to support the WOC's recommendations for additional in-stream monitoring, future agriculture surveys and PLAT field assessments. Other funding and implementation needs include research for continued validation of BMP effectiveness and continued outreach to farmers and those affected by the rule. Additional implementation recommendations include the development of an online reporting and tracking system for municipal biosolids and coordination with state and local health departments who may already track municipal biosolids applications. The WOC will continue to collaborate with the Division to identify additional funding sources for the research and implementation needs discussed above.

Appendix A – Historical Development of the Nitrogen Loss Estimation Worksheet

Nitrogen Loss Estimation Worksheet, or NLEW, was initially developed in 1995 by the USDA - Natural Resource Conservation Service (NRCS) as a field-based procedure to estimate and report nitrogen loading from agricultural fields. State NRCS staff developed the procedure in consultation with NC State University faculty and southern regional NRCS staff. In this initial application, the tool was referred to as the Conservation Effects Program.

In 1996, the NC Division of Soil and Water Conservation (DSWC) initiated statewide use of this early version of NLEW to document beneficial nutrient and soil effects of BMP systems implemented through the NC Agriculture Cost Share Program for nonpoint source pollution control. DSWC also utilized the early NLEW in 1997 under the Tar-Pamlico nutrient strategy to prepare the agricultural portion of the first annual report on implementation of the voluntary NPS strategy.

Because field-by-field evaluation and aggregation for all counties in the basins were not considered an option given time and resource constraints, a more robust and versatile nitrogen accounting tool was needed, particularly for the Neuse and Tar-Pamlico nutrient strategies. In 1996, a multi-agency team began a critical reevaluation of NLEW. This group included representatives from DWQ, NCSU, DSWC, NRCS, and NCDA&CS. A central issue was the adaptability of the field-scale tool for operation at the watershed or county scale.

Scaling up to a county level presented a number of challenges. These included determining the baseline level against which to measure progress towards the reduction goal. County-scale soil and crop information was readily available. However, accurate historic fertilization rates on a large scale would be challenging, as would extent of existing BMPs, such as buffers.

The NLEW Committee developed the current tool under Neuse and Tar-Pamlico agriculture rules over the course of several years. That tool, referred to as NLEW Aggregate, treats each county in an aggregated fashion. All fields in a county are combined and considered as one field with a combination of different soil types, crops and fertilization rates. To accomplish this, Soil and Water Conservation Districts (SWCDs) were contracted to complete surveys wherein they would aggregate certain information at the county level. The Local Advisory Committees (LACs) were asked to verify crops and crop acreage within the basin in their counties, and to determine fertilization rates and extent of BMP coverage. This approach relies in part on information and best professional judgment from local technical agencies (SWCDs, NCSU Cooperative Extension Service, NRCS, NCDA&CS, and the Farm Service Agency). As an additional check, county information is reviewed by DSWC staff and basin oversight committees prior to use in baseline development and preparation of annual reports. While relying in part on local agency best professional judgment may introduce some error into the procedure, the Jordan Lake WOC is confident that using NLEW at the county level provides the best available estimation of nutrient dynamics.

Appendix B: Detailed Flow of NLEW

The essence of the Nitrogen Loss Estimation Worksheet is a field-scale, empirically derived spreadsheet model that estimates nitrogen export from agricultural management units through surface water and groundwater partitioning of nitrogen movement. Moreover, the primary goal of field-scale NLEW is to estimate relative reduction in that nitrogen export through a pre- and post-BMP implementation calculation. A step-wise description of NLEW is provided here. The output of the worksheet is an estimate of nitrogen export from the cropped area and reduction in that export, not an estimate of delivery to surface water.

What is it?

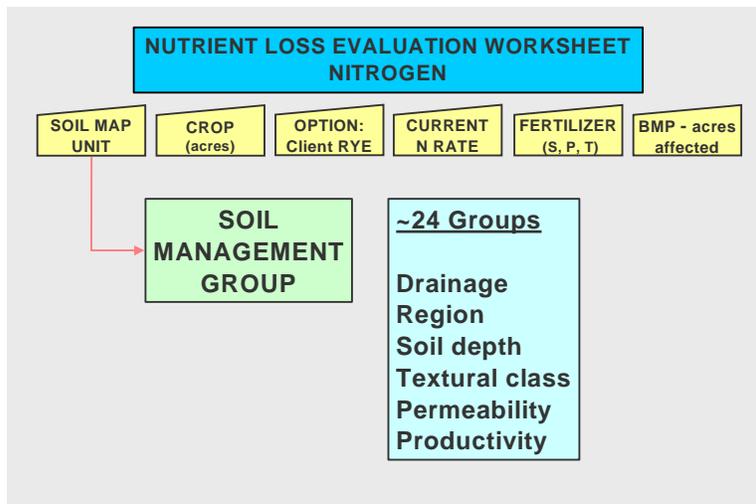
The Nitrogen Loss Estimation Worksheet is a field-based procedure to estimate nitrogen export from agricultural management units. The primary goal is to estimate relative effects of the implementation of best management practice systems on nitrogen export through a pre- and post-BMP implementation calculation.

What information is needed?

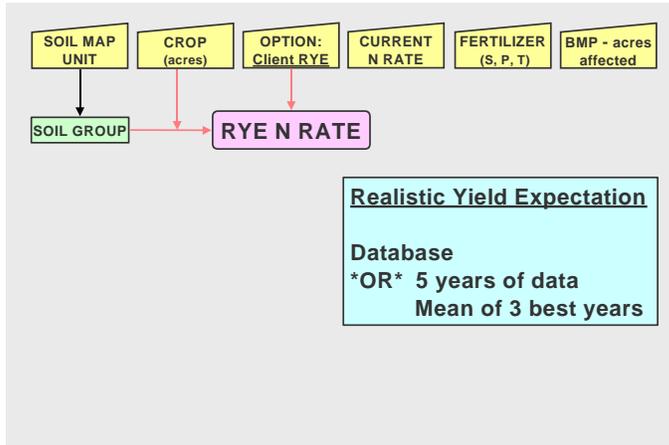
- Soil series
- Crop
- Crop acreage
- Current nitrogen rate
- Previous yield and fertilizer information
- Fertilizer source, placement, and timing information
- BMPs implemented, and acreage effected by BMPs

How does the program work?

- Soil series and mapping unit information is used to assign the soil series to a soil management group. The soil management groups are based on various soil parameters such as drainage, soil depth, and texture



- Based on the soil series/soil management group, a realistic yield expectation (RYE) value and a recommended fertilization rate are specified for the specific crop grown that year. Previous yield records may substitute for the RYE.

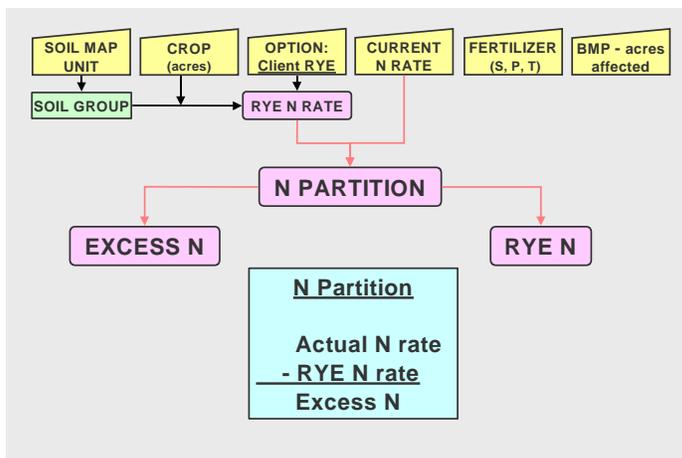


- Each crop has designated nitrogen use efficiency. (see table)

N Use Efficiency by Crop

| Crop | NUE, % | Reference |
|--------------------------|--------|---|
| Bermudagrass | 75 | Woodhouse, 1969 |
| Corn: Tidewater, Arenic | 40 | Chancy, 1982 |
| Coastal Plain, Irrigated | 55 | Kamprath, 1986 |
| Piedmont, Conv. Till | 40 | Wagger, 1992 |
| Piedmont, Cons. Till | 55 | |
| Soybean, nodulated | 25 | Israel, 1998 |
| Sweet Potato | 40 | Ortega, 1996 |
| Tobacco: Burley | 40 | Mackown, 1996 |
| Flue-cured | 50 | Sisson, 1991 |
| Wheat, Oat, Rye, Barley | 45 | Scharf, 1993 Frederick & Camberato, 1995 |

- Current nitrogen rate as well as fertilizer source, placement, and timing completes the information needed to partition nitrogen between the nitrogen needed to fulfill the RYE and any excess nitrogen.

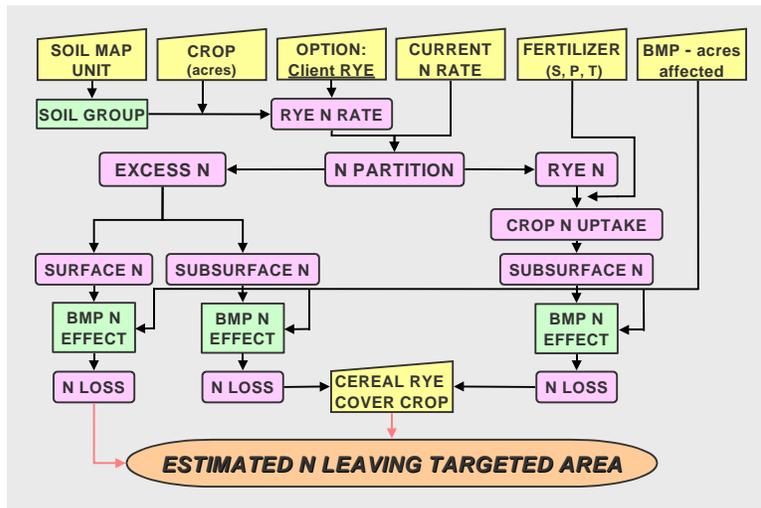


- BMP information generates an interception efficiency that is assigned to the surface and subsurface nitrogen pools.

N Interception by BMPs

| Best Management Practice | % N Reduction |
|--------------------------|---------------|
| 20' Buffer | 20 |
| 30' Buffer | 25 |
| 50' Buffer | 30 |
| 100'+ Buffer | 35 |
| Cover Crop - Wheat | 5 |
| Cover Crop - Oats | 10 |
| Cover Crop - Rye | 15 |

- After calculating the nitrogen loss from RYE nitrogen and the excess surface and subsurface nitrogen, the values are summed to provide an estimate of nitrogen leaving the targeted area. These values represent fertilizer that was applied and neither used by crops nor intercepted by BMPs in the evaluated area. They may not represent the actual nitrogen loading to streams.



Appendix C: Membership of Falls Watershed Oversight Committee

| Affiliation | Representative |
|---|---------------------------------------|
| Division of Soil and Water Conservation | Kelly Ibrahim |
| United States Department of Agriculture - Natural Resources Conservation Service | Gowon Goode |
| North Carolina Department of Agriculture and Consumer Services | Vernon Cox |
| North Carolina Cooperative Extension Service | Mitch Woodward |
| Division of Water Quality | John Huisman |
| Environmental interests (3 representatives of which at least 2 must be residents of the Jordan watershed) | Peter Raabe, Kathy Lee, Alissa Bierma |
| General farming interests | Anne Coan |
| Pasture-based livestock interests | David Pope |
| Equine livestock interests | Barbara L. Olsund |
| Cropland farming interests | Talmage Layton |
| Scientific community with experience related to water quality problems in the Jordan watershed | Dr. Deanna Osmond |