Directors'

Agricultural Nutrients and Water Quality

Working Group

Final Report
and
Recommendations

Ohio Department of Agriculture

Ohio Environmental Protection Agency

Agricultural Nutrients and Water Quality Working Group

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Ohio Department of Natural Resources
James Zehringer, Director

Ohio Environmental Protection Agency
Scott Nally, Director

Ohio Department of Agriculture
David T. Daniels, Director

Background

While the issue of the impact of agricultural nutrients on water quality is applicable to all of Ohio's water bodies, the primary focus of much of the working group's discussions has been on Lake Erie.

In fact, the development of this working group itself has a strong foundation in the findings and recommendations of the Ohio Lake Erie Phosphorus Task Force. Specifically, the Task Force analyzed the correlating trends of increasing levels of dissolved phosphorus entering the tributaries of Lake Erie, and increasing occurrences and severity of algal blooms in the Western Basin of Lake Erie. These harmful algal blooms (HABs), which have been especially evident in the Western Basin, have historically occurred under conditions in which phosphorus concentrations are the highest and water temperatures are the warmest.

Lake Erie is unique in that it is the shallowest of all the Great Lakes, and the warmest. Lake Erie is also distinct in that the watersheds of the other Great Lakes are largely dominated by forestlands, while agricultural and residential land uses are more predominant in the Lake Erie watershed.

Given this distinct mix of surrounding land uses, there are many sources of dissolved phosphorus entering Lake Erie.

Working Group

For that reason, the Directors of the Ohio Department of Natural Resources (ODNR), Ohio Environmental Protection Agency (OEPA) and Ohio Department of Agriculture (ODA) called together a diverse working group that included research scientists, agribusiness leaders, and environmentalists to discuss how agricultural practices may be contributing to the deteriorating conditions in Lake Erie and to develop recommendations on how the State of Ohio can partner with the agricultural community to encourage agricultural production practices that promote nutrient stewardship.

The working group met for an introductory meeting on August 25, 2011. Additional meetings were held on September 26, October 17, November 7, December 5, December 19, and January 23. After the initial meeting, the working group divided into three sub-committees: Research, Regulatory & Incentives, and Production. Each sub-committee had a designated facilitator who led the discussion and kept notes.

The establishment of the Directors' Agricultural Nutrients and Water Quality Working Group is significant, and unprecedented, for several reasons. First, while other groups have been more comprehensively focused on identifying all sources of dissolved phosphorus (e.g., wastewater treatment plants, industrial discharges, home sewage treatment systems, etc.), this working group has been singularly focused only on the role of agriculture.

Secondly, the diversity of stakeholders which comprised this working group is unique. Never before have so many individuals and organizations been convened on this issue, representing such a broad array of interests and expertise. In addition to the directors and staff from the three agencies, participants of this working group (see **Attachment A**) ranged from agricultural businesses and certified crop advisors, to representatives of the Ohio Farm Bureau Federation, Ohio Farmers Union, Ohio AgriBusiness Association and Ohio's major commodity organizations, to the Ohio Environmental Council and the Nature Conservancy. Experts from Heidelberg College, the Ohio State University, and the USDA Natural

Resources Conservation Service all greatly contributed to the deliberations. In all, over 125 individuals participated in at least one meeting.

Finally, the working group was unique in that it set out to develop actionable recommendations within a much shorter period of time than many previous undertakings. The group established an overarching goal of finalizing recommendations within five months of its first working meeting.

Goals

The goals of the working group have been to assist the three Directors in:

- identifying research gaps;
- recommending prioritization of future research;
- identifying potential funding sources for research.
- identifying the current regulatory environment (federal, state, and local)
- recommending both regulations and incentives
- identifying and recommending best management practices (BMPs) that can be readily adopted in the short term and long term; and
- identifying methods by which those BMPs can be communicated to both producers and the industry.

Identification of Guiding Principles

During the course of the meetings, and based upon the elements in the general consensus points (see **Attachment B**), the Directors identified several key issues to consider while developing their recommendations.

Agricultural viability must be maintained

With over 76,000 farms and some of the best soils in the nation, it is imperative that the agricultural productivity of Ohio is maintained. Agriculture is the backbone of Ohio's rural communities, our state's overall economy, and our nation's capacity to feed a hungry world. In Ohio's Lake Erie watershed alone, there are nearly 4 million total acres of cropland in the watersheds of the Western Basin and the Sandusky River. As such, the region is a major component of Ohio's total agricultural production.

State and federal resources are not fully aligned

Available state and federal resources have not been fully aligned. Even within state government, awareness and coordination within agencies has not been maximized. In order for any changes in policy to be fully effective, state and federal resources must be aligned under common goals, and meet coordinated metrics that are established upon commonly identified priorities.

Education and communication have been lacking

During the course of meetings of the working group, it became clear that the increase in levels of dissolved phosphorus is by no means a new issue. However, while conservation agencies and academia have known about the movement of dissolved phosphorous for years, it has not been sufficiently communicated to the farming community.

There is no single solution

Though education and communication must be the foundation of all efforts moving forward, it was made clear to participants of the working group that no option should be left off the table. Discussions of possible regulatory options were a consistent cornerstone of every meeting. While it is clear that educational and voluntary measures are the preferred approach, it was also understood that a variety of options and tools, including regulatory measures, may be necessary.

Research is fragmented

The collective body of research which has been conducted on the topic, including everything from tributary water quality to subsurface tiling to soil microbiology, is currently fragmented amongst various universities, and even across multiple departments within the same university. Statewide coordination of applied research is critically needed, especially in guiding future research endeavors. Additionally, research must be readily available to commodity groups, industry leaders and individual producers.

The Foundation: 4R Nutrient Management

In October, the Directors established the foundation of their recommendations by encouraging farmers to adopt production guidelines known as 4R Nutrient Stewardship, which is effective in reducing dissolved forms of phosphorus from impacting waterways across the state.

The 4R concept promotes using the right fertilizer source, at the right rate, at the right time, with the right placement. Recent studies indicate that the timing of fertilizer application, and how well it is incorporated into the soil layer, significantly reduces dissolved phosphorus runoff.

The initial recommendations for improving production practices made by the Directors include:

- Taking frequent soil samplings and following soil fertilization rates based on OSU guidelines
- Not spreading fertilizer on frozen or snow covered ground
- Maintaining good fertilization records
- Incorporating fertilizer into soil layers as much as possible

Support for the 4Rs of nutrient management has also been affirmed at the national level, as the USDA's Natural Resources Conservation Service (NRCS) recently announced key updates to the Nutrient Management Standard, which guides the agency's nutrient management planning with customers. With regard to overall nutrient management, these revisions stress the elements of right amount, right source, right placement, and right timing.

Recommendations

Based upon the various issues which have been identified and vigorously discussed during the seven meetings of the Directors' Agricultural Nutrients and Water Quality Working Group (summarized in **Attachment C**), and in consideration of those additional recommendations which have been formally submitted (see **Attachment D**), the directors submit the following recommendations:

Framework for Prioritization

Given the vast differences in the intensity, type and concentration of agricultural production in Ohio's watersheds, and the significant variations in the geography, surrounding land uses and overall health of watersheds throughout the state, a framework for prioritization is needed to ensure that effort and resources are strategically directed towards maximizing results.

Therefore, a three-tiered system of watershed classification should be utilized that prioritizes all of the recommendations discussed below, with regard to changes in production practices, direction of available programming dollars, and focus of research. At the same time, any potential regulatory changes should be incrementally implemented in accordance with this three-tiered prioritization structure.

A. Level 1: Watershed in Distress *(e.g., Grand Lake St Marys)*

Watersheds in distress (as designated by the Chief of the Division of Soil and Water Resources) are those in which the deterioration of water quality is such that exposure would likely be harmful to the health of humans that come in contact with or consume it.

B. Level 2: Critical Natural Resource Areas *(e.g., Western Lake Erie Watershed)*

Critical Natural Resource Areas are defined in the Ohio Revised Code as an area, identified by the Director of Natural Resources, in which occurs a natural resource that requires special management because of its importance to the well-being of the surrounding communities, the region, or the state.

C. Level 3: Statewide *(i.e., Majority of state that is not in a Level 1 or 2 area)*

Watersheds in the state not classified as Level 1 or Level 2 watersheds but in which many of the nutrient management practices described below are not required but are recommended.

At each level, a process/trigger for developing nutrient management plans, programs and procedures should be developed including a separate Nutrient Management Plan process for farms involved in livestock production permitted & non-permitted) and crops. On those farms where both livestock and crops are produced, the plan would incorporate both aspects.

In utilizing this overall framework to implementing any recommendations, the primary goal is ensure that any given watershed in the state is eventually moved to a Level 3.

Soil Testing

Stemming from the principles of the 4R model, and after much discussion about Ohio's current regulatory environment regarding agricultural nutrient management and identifiable gaps in finite research on the issue, the Directors believe that a long-term goal for the State of Ohio should be to develop and implement a statewide, standardized soil testing program.

Initially, a pilot soil testing program should be established within a sub-watershed in a Level 1 or Level 2 designated watershed where data indicates a strong correlation between agricultural nutrients and water quality concerns. A sub-watershed for this pilot should be identified by August 1, 2012.

This soil-testing program would be coupled with nutrient management plans that follow uniform agronomic recommendations (such as those presented in the 'Tri-State Fertilizer Recommendations for Corn, Soybeans, Wheat and Alfalfa' published by The Ohio State University, Michigan State University and Purdue University) and would vary in degree based on the classification level of the watershed in which the farm is located.

Coordination of Resources

Throughout the working group process, many examples of fragmented government and non-government resources and programs surfaced that would be better utilized if singularly focused toward solving the problem.

Research

Because the collective body of research which has been conducted on the topic is fragmented amongst various universities, and across multiple departments within those universities, Ohio must identify available resources or pursue research dollars to fund highly targeted, applied research on topics such as (but not limited to) tile management strategy, edge of field studies or conservation treatment practices.

Additionally, the creation of an agricultural advisory group to the Ohio Soil and Water Conservation Commission or the Ohio Lake Erie Commission should be evaluated as a possibility for designation as the primary clearinghouse through which agricultural and environmental organizations can provide their funding to research entities.

Regardless of what entity is ultimately the coordinator of applied agricultural nutrient and water quality research, it is highly encouraged that the fundamental elements of such coordination would include:

1. The joint identification of the type of applied research that is needed by a consortium including agricultural organizations, academia, and other non-governmental organizations;
2. Coordination among the varying institutions that may be conducting the applied research;
3. The identification and alignment of funding streams which will support that research.

Programmatic Funding

Between ODNR, ODA and OEPA, program funding sources must be prioritized toward on-the-ground projects in the Level 1 and Level 2 watershed areas.

The Ohio Environmental Protection Agency and the Ohio Department of Natural Resources should provide focused financial assistance for the purchase (or lease) of precision nutrient application equipment or to implement conservation treatment practices. Cost-share or "loaner" programs could also be developed.

Data Availability

The State of Ohio should analyze, and continue to keep updated on the internet, watershed-specific nutrient data. The Ohio Environmental Protection Agency currently publishes an assortment of data on its website regarding testing and projects in the Lake Erie watershed.

Response

Improved coordination is needed between local and state officials in responding to manure spills. Clearer delineation of duty is needed to ensure a timely and comprehensive response to all spill situations.

Communication and outreach

A comprehensive communication and outreach effort, coordinated by the Ohio Department of Natural Resources Division of Soil and Water Resources, should be developed in order to educate agricultural producers on the importance of and methods for nutrient stewardship. The Department of Agriculture has identified $50,000 to contribute towards this effort.

Voluntary Nutrient Certification Program

The Ohio Department of Natural Resources Division of Soil and Water Resources should develop and administer a voluntary, statewide "Certified Nutrient Stewardship Program" that should include incentives for farmers and retailers who earn the certification. Incentives should be identified for this program.

SWCD Cooperator Program

Additionally, the Department should re-vitalize the existing Soil and Water Conservation District Cooperator Program so farmers can show their local communities that they are cooperating with conservation efforts and are engaged in finding solutions to water quality problems.

Fertilizer Regulations

The Directors identified several areas in which regulatory enhancements would be beneficial in meeting stated research and educational needs. Additionally, these changes would allow state agencies to better utilize their existing regulatory authority and build upon existing programs.

Fertilizer Applicator Licensing

The Ohio Department of Agriculture's Pesticide & Fertilizer Regulation section currently issues licenses to pesticide applicators that require continuing education credits every three years. A similar certification and licensing program should be developed by ODA to license commercial and private fertilizer applicators with program curriculum focusing on the 4R concept, and other best management practices which may emerge. To assist in the timely implementation of such a program, one option to consider is the adoption of an online component of the training module.

In the near term, and before the creation of a Fertilizer Certification Program, the current Pesticide Applicators License curriculum should be amended to require a basic block of instruction on the 4R stewardship model.

Fertilizer Data Collection

The Ohio Department of Agriculture's statutory authority should be amended to require the collection of more specific data on where fertilizer sales are made. Currently, fertilizer retailers in Ohio must report to ODA the tonnage (amount) of fertilizer that is sold, but there is no requirement to provide information about where that fertilizer's last distribution point is located.

Fertilizer retailers (as the last point of sale) who sell fertilizer to a farmer should report not only how much fertilizer has been sold, but also the location to which the fertilizer has been sold (either the county or zip code). In addition, ODA should require fertilizer retailers to provide an additional report on the amount and location (county or zip code) of fertilizer that the retailer is applying on behalf of the farmer. The purpose of this change would be to provide more data for research and to guide future policy making decisions.

Authority of the Division of Soil & Water Resources

As a means of dealing with habitual bad actors, the Director of ODNR should re-assess the existing authority by which the Division of Soil and Water Resources can issue orders to more aggressively pursue and regulate persons with continued violations.

Additionally, the authority of the ODNR Division of Soil and Water Resources should be clarified to allow the Division to develop nutrient management plans when the primary nutrient being applied is manufactured fertilizer.

Chapter 1511 of the Ohio Revised Code should also be amended to include manufactured fertilizer and biosolids in the definition of Nutrient, and Agricultural Pollution (as used in ORC 1511.02 and related revised code sections) and to include "sub-surface drainage". These changes would modernize the statutory authority of the Division to more comprehensively regulate nutrient movement into the state's waters.

Attachment A

This document provides a list of those individuals and organizations who have participated in the Directors' Agricultural Nutrients and Water Quality Working Group:

Abbruzzese, Chris	Ohio EPA
Abele, Jerry	Lake Erie Charter Boat Association
Adkins, Matt	ODNR SWR
Aichele, Nathan	ODA
Alvey, Ken	Lake Erie Marine Trades Assoc
Amin, Dr. Mohammed	ODA
Anderson, Tony	Farmer/County Commissioner
Antosch, Larry	Ohio Farm Bureau
Arnold, Glen	OSU Extension
Ashworth, David	Novozymes BioAg, Inc.
Bailey, Mike	ODA
Baker, Dr. David	Heidelberg University
Bankey, Mindy	OFSWCD
Baumgardner, Gene	Ohio Corn & Wheat Growers
Beal, Matt	ODA
Beiler, Joe	VanTilburg Farms
Benner, Steve	S & D Application
Berning, Tim	Ohio CCA Board
Black, Rocky	ODA
Bray, Kellie	CropLifeAmerica
Breece, Dr. Donald	OSU - Extension

Broering, Paul	ODPA
Brookes, Cindy	Sandusky River Watershed Coalition
Brown, Ed	Crop Production Services
Brown, Larry	OSU - Food, Ag & Bio Eng.
Burkett, Frank	Ohio Farm Bureau
Busdeker, Douglas	The Andersons, Inc.
Byrum, Dr. Bev	ODA
Chakeres, Jim	Ohio Poultry Association
Chapman, Karen	Environmental Defense Fund
Cobb, Glen	ODNR
Coleman, Jennifer	Ohio Soybean Council
Coulon, Chris	USDA
Cross, Brenna	Blue Stone Solutions, Ltd.
Cross, Diane	Blue Stone Solutions, Ltd.
Cross, Ed	Blue Stone Solutions, Ltd.
Davis, Bret	Ohio Soybean Association
Davis, Steve	NRCS
Dayton, Libby	OSU-SENR
Dudley, Dan	Ohio EPA
Elder, Kevin	ODA
Fausey, Norm	USDA-ARS
Fontana, Tom	Ohio Soybean Council
Forshey, Dr. Tony	ODA, Interim Director
Gates, Brett	ODA
Gates, Daryl	Morral Companies

Gebhardt, Karl	ODNR -DSWR
Gibson, Russ	OEPA - Surface Water
Graham, Adam	Ohio Soybean Council
Grimes, John	OSU Extension
Hammon, Fred	ODNR - DSWR
Harsh, Elizabeth	Ohio Cattlemen's Assoc.
Hendrick, Ron	OSU
Henney, Chris	Ohio AgriBusiness Association
Hess, Carl	Farm Credit Services
Hesse, Gail	Ohio Lake Erie Commission
Higgins, Scott	Ohio Dairy Producers Association
High, Roger	Ohio Sheep Improvement Association
Hines, Kirk	ODNR-DSWR
Homan, Eugene	OSGMP
Hoorman, Jim	OSUE - Mercer
Hostetler, Brent	Ohio Corn & Wheat Growers
Irvin, Jack	Ohio Corn & Wheat Growers
Isler, Dick	Ohio Pork Producers
Jones, Belinda	OPARR
Jones, Laura	ODNR
Keller, Steve	Morral Companies
Kessler, John	ODNR - DSWR
King, Kevin	USDA-ARS
Knapke, William	Ohio Pork Producers
Koehler, Brandi	Ohio FSA State Office

LaBarge, Greg	OSU Extension
Linebaugh, Neal	DFA Mideast
Logan, Joe	The Ohio Environmental Council
Lohstroh, Michelle	USDA-NRCS
Lozier, Ted	ODNR
Lust, Tina	Certified Crop Advisors
McClure, Terry	Ohio Soybean Council
McCoy, Denise	ODNR
McDevitt, Steve	NRCS
Mead, Janelle	ODA
Menke, Tom	Menke Consulting
Merritt, Kirk	Ohio Soybean Council
Moore, Richard	OSU-SENR
Morris, James	Ohio Water Science Center
Moser, Dr. Bobby	OSU
Motter, John	Ohio Soybean Council
Nally, Scott	Ohio EPA, Director
Nicholson, Tadd	Ohio Corn and Wheat Growers
Pennell, Gary	Farmers Elevator Grain & Supply
Phelps, Frank	Farmer/County Commissioner
Pitchford, Erica	ODA
Rausch, Jon	OSU Extension
Renner, Nick	Mercer County SWCD
Reutter, Dr. Jeff	OSU-Sea Grant and Stone Laboratory
Richards, Dr. R. Peter	Heidelberg University

Ricker, Dale	OSU Extension
Rockhold, Ronald	Ohio Corn & Wheat Growers
Russell, Dave	Brownfield Ag Network
Sasson, Anthony	The Nature Conservancy
Scanlon, Karen	Conservation Technology Information Center
Scarpitti, Mark	USDA NRCS
Schmidt, Stacy	The Andersons, Inc.
Schrimpf, Paul	Croplife Magazine
Schumm, Mike	
Schwartz, Dan	Ohio Soybean Council
Sharp, Adam	Ohio Farm Bureau
Shearer, Scott	OSU
Shimp, Fred	ODNR
Sloan, Dale	CAA Board - Channel Bio
Smith, Mark	NRCS
Stanley, Bill	The Nature Conservancy
Stark, John	The Nature Conservancy
Stimpert, Keith	Ohio Farm Bureau
Strait, David	Mercer Landmark
Stuckey, Kent	OFSWCD
Sunderman, Mark	Deshler Farms
Sundermeier, Lee	Morral Companies
Sutton, Don	OPARR/Ohio Turfgrass Foundnation
Swartz, Kris	OFSWCD

Swartz, Nate	CCA Board
Unger, Rick	Lake Erie Charter Boat Association
Vollmer-Sanders, Carrie	The Nature Conservancy
Ward, Adam	Ohio Soybean Council
Ward, Andy	OSU
Ware, Andy	ODNR
Watters, Harold	OSU Extension
Weaver, Chris	Bridgewater Dairy
White, David	Ohio Livestock Coalition
Wible, Chris	Scotts-OPARR
Wilson, Mark	Land Stewards, LLC
Wilson, Rick	Ohio EPA
Wise, Howard	ODA
Wise, Roger	Ohio Farmers Union
Witter, Jon	OSU
Wyss, Ronald	Hardin County
Zehringer, James (Director)	ODNR
Zody, Scott	ODNR

Attachment B

This document was developed to capture the general planning assumptions and consensus points that were collectively agreed upon by the various participants in the working group. It reflects those general areas of agreement which serve to frame the discussions of the participants.

General planning assumptions

1) Streams and water resources throughout Ohio are adversely affected by nutrient and sediment loading, which needs to be reduced. Ohio's agricultural industry, which provides food, feed and fiber to the world, has a role to play and is willing to do its part.

2) The water quality of Lake Erie has declined in recent years due to an increase in the amount of dissolved reactive phosphorus being delivered from a variety of sources.

3) Phosphorus is moving from farms and reaching streams and Lake Erie, often in dissolved form.

4) Ohio is dedicated to becoming a national leader in water quality achievements and improvements related to agricultural practices, and in land stewardship.

5) Farmers, government agencies, agricultural associations, conservation organizations, industry and others will work together to help solve these problems.

6) Incentive payments, voluntary efforts, education and outreach, continued research, regulation and other approaches are all on the table as strategies to help drive implementation toward success.

7) We should identify and prioritize those activities that will both result in the greatest amount of reductions in dissolved phosphorus and nitrogen and are relatively simple to implement. To start, we agree that these specific farm level recommendations should be implemented:

- Take soil tests and follow fertilization rates as found in the Tri-State Recommendations and/or OSU Recommendations
- No spreading of phosphorus on frozen or snow covered ground
- Maintain good nutrient application records
- As much as possible, incorporate nutrients into the soil layer or on a growing crop at the appropriate time
- Follow the 4R Nutrient Steward guidelines found at: nutrientstewardship.com
- Continued research will be monitored to implement the latest proven practices

8) State and federal agencies and agricultural commodity & trade associations will establish and promote nutrient management programs.

Attachment C

This document was developed to serve the working group's discussion tool in providing the directors with the group's: 1.) identification of the key issues that have been brought forward during the course of discussions; and 2.) assessment of all sides of any issue which could potentially emerge into a recommendation.

This document is a compilation of the individual comments from individual participants of the working group. As such, this document is not intended to convey general consensus or full agreement on any given topic among the participants in the diverse working group.

Key issues (or potential recommendations that the directors may consider) have been identified as an "Issue/Recommendation." Any correlating discussion of a given identified key issue can be found as a "Discussion Point/Concern." The key issues, and any relevant discussion points, have been clustered into one of four general topic areas in this document: 1.) Research; 2.) Education, Communication & Outreach; 3.) Regulatory & Incentives; and 4.)Production. These broad topic areas reflect the comprehensive deliberations in which the participants in the working group have been engaged.

Research

Issue/Recommendation #1: *A "Questions Committee" should be established.*

Discussion Points/Concerns:

- A questions committee will be established to create a list of questions that can be asked of state agencies, organizations and individuals to help fill in some research gaps. This group will begin meeting in January 2012 for the purpose of creating questions for presentation to CCAs and during pesticide training programs. Realizing that the majority of people participate in the 2013 training, the 2012 training will be used to assess the responses to test question.
    - Establish the overall focus for the list of questions that will be compiled by the questions committee (e.g., transport, delivery, fate, impact, control and reduction of nutrients to Lake Erie).
- This group should begin meeting in January 2012 for a rollout of questions to the 2012 pesticide certification group. The purpose would be to get initial responses so the questions can be fine tuned for the 2013 group. Additional questions will also be asked of the CCA group that meets as well.
- Potential membership of such a committee should include: Dr. King; Dr. Dayton; Dr. Reutter; Tom Menke; Tim Berning; Tom Fontana; Dr. Larry Antosch.
    - Need to have some producer representation, both grain and livestock.

Issue/Recommendation #2: *A "Research Review Committee" should be established.*

Discussion Points/Concerns:

- Need to specify what the purpose of this committee is to be.
- Describe what this committee will do (e.g., "review ongoing and recently completed research, prepare summary for communication and outreach activities.").
- Membership should include universities, state/federal agencies, producer groups and non-governmental organizations (as appropriate).
- The agency directors should determine the composition of the group, and it should include agency staff, researchers, producer group representatives and non-governmental organizations (NGOs).
- Potential membership of such a committee should include: Dr. King, Dr. Dayton, Dr. Reutter, Dave Baker, Jon Witter, Larry Antosch, Carrie Vollmer-Sanders, Dale White, UT, etc.
- Need to have producer representation on this committee.

Issue/Recommendation #3: *An accessible research database should be established.*

Discussion Points/Concerns:

- This is good as long as the target audience is kept in mind- we need easily accessed and ready-to-implement information that farmers and those advising farmers with nutrient management recommendations can put to work, linked to supporting research for those needing the additional information (web based tool).
- Need to be careful we don't put information out of reach of the producer who will drive the final results.
- If research is for producers, make sure it is useful to them. Much of the research already does exist, but new research is always coming online.
- Consolidate on-going and completed research for easier access by producers, producer groups, and other researchers.
- The Ohio State University (Dr. Jon Witter) has begun the process of creating a searchable database of phosphorus research projects as well as literature reviews. Usernames and passwords will be circulated amongst the group to review and input information.
    - Include USDA, ARS, Soil Research Unit as an organization working on the creation of the searchable research database.

Issue/Recommendation #4: *The following areas have been identified as being of first priority for future research:*

A.) Funding is needed to enhance current prediction technologies (P-index, SWAT, EPIC/APEX, SPARROW, AnnAGNPS, and others)

Discussion Points/Concerns:

- Identify what prediction capabilities need to be enhanced (e.g., identification of critical management areas in crop fields, identification of critical portions of watersheds, evaluation of the impact of management practice implementation on water quality, estimation of total loads to Lake Erie).
- Research funding should be focused in area of Dr. Dayton's proposed edge of field testing program and updating and validating the P-index.
- Much needed, but be careful to explain what these acronyms mean- better yet what they are to accomplish in regards to water quality improvement expectations. A properly designed P-index incorporates many appropriate BMPs for P management.
- There are currently adaptive nutrient management programs in the Maumee and Grand Lake. The program has proven ability in Ohio and elsewhere to provide useful data back to farmers that allows them to further fine-tune nutrient applications so it's both a research (did what you applied get used by the crop?) and an implementation program (taking aerial imagery, corn stalk tests, P trials, etc). Programs are currently funded with a combination of public and private dollars -- more such programs could be put into place with additional partnerships and adopted quickly.
- Technology should be made available ASAP, for highly motivated producers/environmental stewards, to have the capability to access, monitor, and manage real time data and results, specific to *their* fields and farms.
- Use of P-Index by farmers must work easily and produce meaningful results. The USGS model is an example of bad science.
- Dollars should be focused to enhance accessibility and ease of use for the farming community. For instance, the P-index or similar technology should be made available on-line and in a dynamic format to allow farmers to calculate the advantage to implementing different management practices.
- Coordination should be conducted at the front end.
- It should be recognized that many elements of these predictive technologies need further research to support the values given to management practices. Those research items may be listed below.
- The USGS predictive model should be validated. Problems with load estimations, data summarized from whole side but not Canada. Major source on non-point is left out. Distorts data, One side is exaggerated.

B.*) Spatial scale land-based studies (Edge-of-field or upland {surface and subsurface}, ditch/stream network, lake);*

Discussion Points/Concerns:

- This type of research is difficult and expensive to carry out. A lot of this research has been done and essential principles are understood. We need to use this existing information now before we do a lot of research that only "fine tunes" what we know now.

- A specific Sub-Watershed should be determined for testing as a demonstration watershed (suggestions of Upper Blanchard, Chickasaw Creek (Grand Lake St. Mary watershed), Rock Creek or Honey Creek, Pusheta Creek; watershed in Lake Erie watershed with long-term water quality database is recommended).
- Differing spatial-scale, land-based studies in the natural environment are needed to elucidate and quantify the benefits of different management practices.

C.) *Temporal changes in agricultural practices and land management activities and associated environmental responses (review of tile installation and density, GMO adoption, tillage, glyphosate monoculture, climatic shifts, P formulations, etc*);

Discussion Points/Concerns:

- Good research for long-term evaluations.
- Comprehensive tile and water management systems that account for crop production needs and downstream water quality and quantity concerns should be developed for intensively drained agricultural landscapes.
- A non-intended consequence may have resulted from adoption or implementation of any one or series of management practices including subsurface tile, GMO adoption, shifts in tillage practices, and consistent use of like herbicides that may change the soil microbiology.

D*) Socioeconomic assessments (i.e. buying fertilizer in fall for tax purposes and applying in spring*).

Discussion Points/Concerns:

- This is an area where business/economics will interface with WQ goals and we will find some divergent opinions but crucial discussion.
- Much more could be done to identify possibilities for innovative partnerships/business opportunities or investments such as composting food wastes and manure, identifying potential for multi-farm digesters, or other "out of the box" ideas that have been tested elsewhere and might have application in Ohio.
- Socioeconomic research is needed to gain a better understanding of why certain practices are adopted and decisions are made by the producers.
- The following factors must be considered as part of the research:
    - Structural challenges, storage, transport, application, equipment, contractual\legal etc, weather conditions, contractual obligations, and time constraints.

E.*) Agribusiness industry structure and service delivery*.

Discussion Points/Concerns:

- There is a need to understand the current structure of the agribusiness industry in order to purpose realistic modifications (e.g., contractual issues, storage capacity, etc).
- Consider fertilizer solubility enhancers

F.*) Treatment Technologies*.

Discussion Points/Concerns:

- Bioreactors
- End-of-tile filters
- In stream treatment systems
    - Two-stage ditches
    - Constructed wetlands
    - Self-forming channels
    - Natural Channel Design
    - Instream Amendments/Dosing Systems
    - Surface/Blind Inlet Treatment

G.*) Improve Stream Ecology Management.*

Discussion Points/Concerns:

- Intended Uses (IBI, ICI, QHEI, etc.)
- Streams are natural biological treatment systems

H.*) Pathways in the field, to the edge of the field, and from the field*.

Discussion Points/Concerns:

- Research is needed on the partitioning on precipitation between surface runoff, soil matrix flow and storage, macropore and surface inlet flow to subsurface drains, and pathways (flow and storage), to receiving waterbodies and in these waterbodies.
- This research should be integrated into the research for items B, C, F, and G.

Issue/Recommendation #5: *Target Reduction should be identified.*

Discussion Points/Concerns:

- What science backs up the recommendations?
- Until we know how DRP is leaving the farm, target reduction rates should not be arbitrarily set.
- Add language that emphasizes (1) Until reliable predictive ecological cause-effect models become available the establishment of a dissolved reactive phosphorus load reduction target is strictly for program planning purposes only, (2) the reduction target is applicable to all sources of phosphorus, and (3) the target must be based on realistic expectations of anticipated ecological response.
- An initial focus should be on use of 4-R type BMPs. We may need to provide incentives for farmers to use row starters again, while at the same time discouraging use of fall broadcast P applications with full width tillage.

- Setting numerical reduction goals appears to be a reasonable exercise, but this is very elusive subject to weather events that may give false hope one year, and then large disappointments the next.
- If we know of practices that can be implemented that do indeed reduce DRP and N loss from the farm, then perhaps the target should be acres implementing these practices, knowing that over the long term a positive impact will occur regardless of year to year variations.
- We get trapped into looking for quick, political responses to issues that are generational in scope. We need to appropriately "manage the expectations" as well.
- While there are many estimates on what the desired load reduction might be, the group presented several questions on what the appropriate reduction may be. In the end, many in the group felt as though research and assessment was needed to determine what that reduction should be in order to achieve the desired result.
- A target of a minimum of 50% reduction in dissolved reactive phosphorus loading to the lake from all sources.
    - If reductions from all sources, how much assigned to agriculture?
    - A time frame needs to be established.
    - Concern over how such a target would be measured.
    - Maintain Heidelberg Monitoring Program so we can determine changes in loading.
    - Expand Heidelberg Program so we can better determine loading from individual tributaries in Maumee watershed.
    - Consider other sources and programs regarding water quality monitoring.

<u>Issue/Recommendation #6</u>: *The following areas have been identified as being of secondary priority for future research:*

A) Windows and Weather

<u>Discussion Points/Concerns:</u>

- Add language that reflects the need to evaluate and identify what are the current windows of opportunity (days, weeks, months) for farmers to farm (prepare seed bed; plant crops; apply nutrients, soil amendments and crop protectants; harvest crops).
- This should not be a high priority, as Ohio's weather is too variable for specific windows.
- Worthy of future and continual investigation.
- Taking advantage of Heidelberg's research, is there a way to provide BMP practices on time windows and weather events.
- What is the best time for application? Benefit to smaller and more frequent application versus one larger application.

- Using Heidelberg's research, guidelines should be given on appropriate times to apply phosphorus with predicted weather events. These guidelines should be given to prevent run-off while allowing flexibility for the farming community.

B) Cover crops

Discussion Points/Concerns:

- Disagree that this should be a secondary priority. In NW Ohio, proper use of cover crops could do a lot with respect to slowing runoff rates.
- Worthy of future and continual investigation
- Could be deleted. It is covered more generally under Research Issues/Recommendation #4 Item B. Keep cover crops on list of management practices to evaluate.
- The level of effectiveness and the difference in cover crops.
- Do they need to be harvested (if left to breakdown, will plant material release nutrients)?
- Compare incorporation into soil to cover crops to prevent P runoff.

C) Changing weather patterns and their impact on rainfall events.

Discussion Points/Concerns:

- Evaluate current structural agricultural management practice design specifications to determine if a revision is needed due to observed changes in storm characteristics.

Issue/Recommendation #7: *More data should be collected, including better tonnage data collected by ODA.*

Discussion Points/Concerns:

- Understood the need for such data, but getting data from the private sector and putting it in the hands of public agencies may not be realistic unless a very clear benefit to the private sector can be articulated and then it can only be voluntary.

- How would this data be used? Field level data supplied by farmers willing to provide the data would be better and result in potentially better on the ground fertilizer usage.
- Farmer on farm networks could perform this function.
- This could be deleted. It is covered more generally under Research Issue/Recommendation #1 (Keep topic on list to be investigated by questions committee).
- As baseline survey on current fertilizer practices should be conducted ASAP, so we can measure change over time.

- It is believed that many questions on farming practices could be answered through voluntary submission when data is collected by state and federal agencies and through meetings of various producer groups. A committee is being established to brainstorm that list of questions.
- ODA should attempt to collect better tonnage application data:
  - County-by-county and month-by-month of when applied and would be best.
  - Capture current on-farm practice data.
  - Concern that industry will not have accurate records on when the application occurs.
  - Data on how applied would also be helpful.

Issue/Recommendation #8: *A specific Sub-Watershed should be determined for testing as a demonstration watershed.*

Discussion Points/Concerns:

- There seems to be several demonstration watersheds currently. What would be different here and the expected outcome(s)?
- This is a practical approach and should be given greater priority.
- In order for this to be effective, must have the ability to control management decisions on a large percentage (if not all) of the land in the demonstration watershed for a long period of time.
- Consider the use of a sub-watershed for testing; determine a sub-watershed (suggestions of Upper Blanchard, Chickasaw Creek (Grand Lake St. Mary watershed), Rock Creek or Honey Creek).

Issue/Recommendation #9*: Biodigesters.*

Discussion Points/Concerns:

- Biodigesters do not address nutrient management and don't need to be part of this discussion.
- Biodigesters have minimal impact on reducing phosphorus. Byproducts of anaerobic digestion could serve as an alternative to traditional fertilizer and organic soil amendments.
- Encourage the use of biodigesters as a method for disposal of manure in areas of intense livestock production; identify new technologies and the means to fund and promote adoption of the practice.
- This could be deleted. It is covered more generally under Research Issue/Recommendation #1 (Keep topic on list to be investigated by questions committee).

Issue/Recommendation #10*: Role of turfgrass in phosphorus application*

Discussion Points/Concerns:

- Needs to be evaluated to determine the extent to which turf management can/does impact WQ in Ohio.
- This should be deleted. Focus of this working group is agricultural nutrients and water quality not turf management.
- Recommend changing focus of this Issue/Recommendation to address specialty crops, nursery crops and landscaping. All of these agricultural activities are present in the Lake Erie Basin.

Issue/Recommendation #11*: OSU should place a high priority on hiring a fertility specialist with a specific focus on DRP, nutrients and production best management practices to better centralize and manage these issues.*

Discussion Points/Concerns:

- This fertility position should focus on water quality and updating Tri-State Fertilizer Recommendations. The Tri-State Recs are very outdated and do not reflect current farming practices, yields, etc.

Issue/Recommendation #12*: Measurements of success need to be established.*

Discussion Points/Concerns:

- Need to track and measure our goals; where did we start and what is our end goal?
- How will that be quantified?
- Measurements should be taken as close to the fields as possible, and not just at Lake Erie

Issue/Recommendation #13*: A funding mechanism should be established to support research, education and producer incentive initiatives to reduce downstream exports of nutrients.*

Discussion Points/Concerns:

- Develop an approach similar to that used by Illinois. For example, a four to five dollar/ton check off fee on fertilizer sales would generate more than ten million dollars annually. This fee would be less than 1% of the cost of the fertilizer.
- Education (5-10%), Research (15-20%), Incentives (70-80%) or something similar.
- Who would manage this and make funding decisions?

- Perhaps establish a multi-institutional water quality program at OSU that included Heidelberg University, UT, USDA-ARS and others.
- Consider establishing a credit program for businesses that participate in the program. Target the application practice (i.e., good stewardship).
- Consider the ultimate economic impact to farmers (any fees on fertilizers will eventually be passed on to the farmer).

Issue/Recommendation #14*: Consideration should be given to research needs that have been identified in other initiatives such as by the Ohio Phosphorus Task Force.*

Discussion Points/Concerns:

Education, Communication & Outreach

Issue/Recommendation # 1: *An education committee should be established.*

Discussion Points/Concerns:

- Need to establish education action committee that will interact with the research and production committee to develop a strategy plan include existing publications and communications tools (such as agronomy guide, tri-state fertility guide, fact sheets for Ohioline) geared towards the appropriate audience.
- Need to develop new education materials that are specific to nutrient impacts on water quality and the environment and BMPs to reduce these impacts. These materials will be developed in collaboration with the research and production committees.
- Composition of the education committee needs to be established (leadership by OSU Extension- Andy Ward?)
- An assessment should be completed to determine how producers are using this information.

Issue/Recommendation # 2: *Develop an issue outreach campaign.*

Discussion Points/Concerns:

- The development of an effective outreach campaign involves a sequence of steps than can be grouped into five phases (assuming improving an protecting Lake Erie Water Quality is the goal): 1.) needs assessment and target audience identification and analysis, 2.) creation of audience specific message(s), (3) formatting the message(s), (4) getting the message out and (5) evaluation of the outreach campaign.

Issue/Recommendation #3: *Communication to Producers and Industry should be enhanced*

Discussion Points/Concerns:

- End user (farmer) education is key. Must come from a trusted source and be able to substantiate the cost savings related to yields. Realize that the little education today (in the form of recommendations) going to the farmer is from those who are selling fertilizer materials, so it needs to be carefully thought through how those people will benefit from this information.
- Opportunities to communicate:
  1. Cost per Acre – communicate the financial savings on reduced p application using Heidelberg's information.
  2. Provide easy to use information to commodity groups and industry leaders.
  3. Researchers need to participate in on-going communications activities so producer groups and non producing landowners are aware of the latest findings.
     - This discussion point could be modified and expressed as a goal to increase science community and producer interaction with an objective of dialogue, feedback and

greater understanding of the issues. Producers need to understand the science but scientists can also learn from producers and create better linkages between field and lab.

4. Help farmers understand agriculture's role in the problem.
5. Help agriculture community understand their impact on Lake Erie.
6. Help them understand likely scenarios if they don't voluntarily take significant actions.
7. This could be easily done by networking with many existing organizations.
8. First priority should be given to education of farmers. A second priority is the curriculum used in CCA and college.

Issue/Recommendation # 4: *Education must be critical first step of any approach; whichever approach is used needs to be state-wide; some form of voluntary program may be best approach in short term, or mandatory training linked to pesticide applicator license training.*

Discussion Points/Concerns:

- To help control cost of implementation, incentive program may need to be coupled to equally strong disincentives.
- This issue could be better articulated. The topic of mandatory training for fertilizer applicators should not be linked with the pesticide applicator license as the problems and resources at risk are serious enough to merit a stand-alone program.
- Education of several kinds must come early in the process and be provided by agricultural entities. The educational approaches should clearly state those steps that need be taken to reduce dissolved phosphorus losses without increasing particulate phosphorus losses.
- Education may be the most critical.
    - Challenge will be how to reach every producer.
    - Stress economics: proper nutrient management plans save money.
- Need to develop a communication plan aimed at delivering DRP issues to producers.
- Education needs to include soil testing information, and a voluntary approach will work if they understand the issues.
- Need to form small communication group to develop a strategy plan to include existing publications and communications tools (such as agronomy guide, tri-state fertility guide, fact sheets for Ohioline) geared towards the appropriate audience. An assessment should be completed to determine how producers are using this information.
    - Composition of communication group and the target audience needs to be identified.
- Combine small pots of money together with the review of the research committee.
- Develop central clearinghouse for latest best management practices.
- Develop website for distribution of information to public.

- Production associations have constant outreach activities with the membership.
- Need focused research to determine edge of field and tile DRP levels.
- Consider centralized database for reporting soil test data.
    - This will need to be aggregate information by regions at best, not identifiable to any specific operation.
    - How can data from laboratories be used in this manner? This is probably not legal because it is private information unless the owner provides consent for the use of the data in very specific ways. May be a liability nightmare for labs and not a practical matter.
- Develop best management practices.
- Concern over balancing increased production required with whatever regulations might be enacted.
- If regulations are required, it must make sense to producers to gain their buy-in.
    - Those doing a poor job without accountability have a competitive advantage over those doing the right things. This is seen frequently between permitted livestock farms and those under the limit.
    - The question always has to be asked: "What's in it for me?" (The potentially impacted person).
- A regulatory requirement may be needed to meet minimum reduction levels.
- Must have a way to measure success of either voluntary or mandatory program.
- Education of nonproducing land owners\general population.
- Education of fertilizer cooperatives.
    - Imperative, down to the level of the employee spreading the fertilizer, and especially the one who is supposed to be interpreting the soil tests.
- Education of fertilizer use industries\consultants\CCAs.
- Possible measurement of voluntary program could be tracking of numbers of individuals that received nutrient management training.
- Use short-term as well as long-term measurements of success for any new regulation or incentive.
- Reduction incentives of 1980 did work.
    - There was a lot of point-source work done during that period that was easily identified and regulated.
- Consider incentives to apply P fertilizers in spring, especially as row starters with corn planters.
- Increase incentive levels to effective BMPs.
    - The days of paying people to do the right thing are limited-in funding and effectiveness.
    - BMP must make economic sense on its own.

- Should every farmer that applies nutrients need to take a class?
    - They should be able to demonstrate proficiency by exposure to nutrient management education.
- Roadmap to education is needed (which is an element of the communications group).
- Education is needed specifically on the impact of farming system(s) on water quality (possible subgroup).
- Ohio Agri Business Association as part of discussion group.

Issue/Recommendation #5 *In addition to the 4-Rs, the following soil quality issues should be addressed:*

A. *Soil organic matter*
B. *Soil compaction*
C. *Water infiltration rates*
D. *Methods to reduce runoff*

Discussion Points/Concerns:

- We need to look at a combination of management practices, and find what combinations are most effective and will actually be implemented by producers, without believing that any one practice is the answer.
- The 4-Rs function to address the dissolved phosphorus issue in the short term; soil quality is generally a more long term matter.
- Soil organic matter has been decreasing.
- Rotational No-Till does not have the same soil quality benefits.
- Benefits of cover crops not well documented on dissolved nutrient movement.
- Many fields are prepared to plant in the fall and have little crop residues or roughness to slow water runoff.

Issue/Recommendation #6 *Provide guidelines for manure and fertilizer application of phosphorus.*

Discussion Points/Concerns:

- Get analysis of all manure applications so we know what is being applied.
- Manured acres for the largest producers are already regulated, as they are in distressed watersheds. Due to economic considerations of applying manure nutrients by producers with limited options, BMPs specific to their situation can be developed that would better address the current situation.

Issue/Recommendation #7 *An Agriculture Nutrient Council should be created, with members appointed by Governor Kasich.*

Discussion Points/Concerns:

- This could be modeled after the Ohio Broadband Council.
- This would be a formalized way to continue the dialogue and provide policy, research and funding priorities to the administration on this issue.

Regulatory & Incentives

Issue/Recommendation #1: *Authority should be given to one of the agency directors to regulate the use of fertilizer.*

Discussion Points/Concerns:

- More research and understanding are needed
- Delete this recommendation. We do not support requiring farmers to obtain a permit to apply lime, fertilizer or other nutrient inputs.
- If we are not even sure of what should be the best management practices, how do we propose regulation?
- How would a new regulatory program be funded? New taxes or fees on farmers? This would certainly raise serious concerns with growers
- When, and if, regulations come, this should be ODA since they are regulating nutrient management from permitted livestock farms and have other licensing duties, such as fertilizer, grain and pesticides.
- Perhaps a test watershed using a combination of approaches might be tried: regulate the fall and/or winter application of P fertilizers; provide incentives for P application in spring at planting or in other ways; required soil testing with agronomic recommendation prior to any P fertilizer application.
- Need research to understand the movement of DRP.
- Concern over "use" being such a broadly defined issue.
- Where does it start and where does it stop?
    - It starts with the use of all nutrients in a manner that minimizes impact on water quality using current BMPs.
- How would licensing program be administered?
    - Look to examples like Indiana.
- Possible linkage to pesticide applicators license.
    - Recognize that not all farmers are licensed due to CCAs.
- Is issue large enough that it needs to be a stand alone process?
    - The seriousness of nutrient water quality problems in Ohio require a serious, concerted and adequately funded fertilizer applicator licensing program. **There should be a stand-alone nutrient applicator licensing program.**
    - There needs to be a program where the selling, recommending and application of nutrients is certified or licensed, depending on specific activity.
    - Start at the simplest level by providing education opportunities.

This document is a compilation of the individual comments from individual participants of the working group. As such, this document is not intended to convey general consensus or full agreement on any given topic among the participants in the diverse working group.

- Concern as to whether this is issue is large enough to be a stand-alone process.
- Possible best fit under ODA.
- Might be best as long-term goal.
- Reminder 1980 - Voluntary with point source regulation.
    - The situation and facts are significantly different today compared to 1980. Adoption of no-till practices in the 1980s had proven cost savings for the farmer; today's situation with broadcast phosphorus fertilizer applications vs. soil incorporation is the opposite situation. There is a cost dis-incentive working against the adoption of the preferred BMP. Should
- Should regulation apply to entire state? Or just apply to one watershed or sub-watershed?

Issue/Recommendation #2: *Consider a certification program modeled after the pesticide program where a certification would be renewed every three years for all applicators of fertilizer.*

Discussion Points/Concerns:

- ODA would be most appropriate agency to administer.
- Certification program could help promote best known management practices and help spread news of better BMPs as research suggests.
- Should anyone applying fertilizer need to have a license?
    - Probably something beyond simply being CCA certified.
    - Concern of who would be the enforcer, and at what cost.

Issue/Recommendation #3: *Need for ODA to collect better tonnage data and look at licensing structure of fertilizer manufacturers/distributors.*

Discussion Points/Concerns:

- Tonnage data would not be a necessary item if BMPs by nutrient retailers were followed.
- Question the need for this, but supportive of gathering data at county level or by zip code, or watershed.
    - Concern over gathering farm data for proprietary reasons.
- It will be extremely important to identify and clearly communicate the reasons behind data collection. Should be a component of the outreach campaign.
- Florida seems to have really good, modern computerized system that could be a model for better fertilizer reporting.
- Collection of tonnage data needs to be simplified in order to gather better data at the use site.
- Best data would be collected from the user through record keeping.
    - Will this data be reliable?

    - This is private data and difficult to collect, can only be voluntary.
- Better data needed for research purposes.
- Fertilizer companies might accept this if they saw a positive benefit to the agricultural industry and producers, including avoiding penalties and regulations.
    - What is the positive benefit-regulation avoidance?
- This would require statutory and possible administrative code revisions.
- This would be accomplished without any fee increases.
- Vehicle to obtain better tonnage information based on the questions group that will be meeting under research.
- Tie to demonstration watershed and perhaps other data sources.
- Tie tonnage information to watershed.
- Web based data collection.

Issue/Recommendation #4: *Nutrient management plans should be required using NRCS 590/633 standards.*

Discussion Points/Concerns:

- Language should be modified to be consistent with the distressed watershed requirements – CNMP and the OSU Nutrient Management Workbook are both acceptable.
- No agency has the authority to implement this recommendation.
- Investigate if a new state law similar to the Kentucky Agriculture Water Quality Act or the Texas Water Quality Management Plan Program would effectively promote, and if necessary enforce, the nutrient management plans plus other recommended whole farm plan BMPs that are initially self-selected by the landowner.
- Restrict the application of manure and commercial fertilizers to recommended agronomic rates.
- Important to point out that until we have a good understanding of the cause-effect relationship it is not known if nutrient management plans will help eliminate the water quality concern. Research Issue/Recommendation #4 will help identify the system of management practices that will be needed as well as leading to the development of better tools to help focus actions to the most critical areas.
- NMPs should be encouraged, not required.
- More research is needed, are NRCS 590/633 standards the most effective?
- NRCS 590/633 are good starting points, but need to be condensed into doable action items for some of the simplest BMPs that will have the largest impact the quickest.
- As the NMPs are currently designed, only a handful of CCAs in the state are willing to write them and have the time, personnel and expertise to do so. If there were to be a requirement that all producers need NMPs, time spent on completing the plans would need to be well-spent, with

the end result being an effective plan that works for the producer and ensures better nutrient management. As they are currently written, few producers can read and understand them, let alone follow them. The process and plan could be improved by reducing paperwork, focusing on the most critical aspects of management, and incorporating better use of data to make decisions for economic and environmental benefit. We advocate for an adaptive management NMP approach and for providing support for that approach through effective training of CCAs and coordination of partners for best use of time and resources.

- Concern over mandatory incorporation due to large acreage being treated.
    - Farmers may view this as a green light to once again begin full width tillage, and potentially more erosion will result and with it increased in the amounts of particulate phosphorus washing from cropland.
    - Crop and water quality benefits of "facilitating fertilizer/soil contact" should be stressed.
- Concern over having enough technical services providers (TSPs) to help with plans
    - Plans do not have to be as complicated as the NRCS sanctioned CNMPs to get desired results. Suggest development of the outline of a Nutrient management plan that is straightforward to prepare, easy to follow by the producer, and is actually implemented because of its understandability.
- Concerns over how to monitor whether plans are being fully implemented due to lack of TSP follow up.
- This would require changing revised code, if regulated.
- As of December 14, 2011, NRCS announced changes to 590/633 standards
    - These appear to be pretty generic as a framework for the states, but not specific enough to give OH new BMPs.
- What constitutes a NMP for this purpose? By when?
    - There needs to be a committee established to look at an effective form of a NMP without going to the burden and producer unfriendliness of a CNMP.
- Group of partners to do the evaluation to determine the NMP.
- Provide incentives to CCA's to complete and use NMP.
    - Incentive needs to be with the producer where the practice is implemented.
- Cost, use, of NMP to demonstration watershed.
- Using P index in partnership with NMP's to see reductions in edge of field.
- Implement practices before watersheds become distressed.
- Simplify plans – place in fact sheets and on website.
    - Simplification and accessibililty should be a priority.
    - Requiring more plans may be counterproductive, as the real value of planning is in the discussion a professional conservationist has with the farmer about his/her specific need.

Issue/Recommendation #5: *CCAs' current mechanism to act as TSPs in developing nutrient management plans should be enhanced and simplified.*

Discussion Points/Concerns:

- Work with NRCS via the State Technical Committee to investigate the possibility of modifying the process to become a Technical Service Provider (TSP) certified to develop CNMP.
- At present time, you do not have to be a TSP to develop nutrient management plans.
- We agree that there should be a simpler process for CCAs to become TSPs, and less paperwork involved; but without reducing quality in the end. CCAs should be able to show they are qualified without the cumbersome process that currently exists.
- Needs to be a self-assessment procedure and intuitive document framework that can be put together by producers, and then reviewed by extension/SWCD/other qualified persons who can assist and validate as meeting the basic BMP goals of nutrient management that will have the largest and quickest impact on water quality.
- Remove this suggestion; TSP program not workable.
- Do not have to be a TSP to put plans together.

Issue/Recommendation #6: C*ommunication with USDA/NRCS to streamline application processes for enrollment into CREP/EQIP programs should be supported.*

Discussion Points/Concerns:

- Formalize concerns to NRCS via State Technical Committee.
- Send letter to USDA-NRCS in Washington.
- Question the need to specifically identify these two Farm Bill programs.
- Keep the goal of farmer education and cooperation outside the purveyance of government funding programs tie-in. Make it of evident value on its own merit.
- Another option would be to afford ag retailers and others in ag business to take some leadership in this area.
- Remove this suggestion; CREP/EQIP are wrong targets.
- Too much funding uncertainty with these programs.
- Equal consideration between crop and livestock facilities.
- Is there a way to streamline?
- Concern that if funding is not available, then spend time in other areas instead.

Issue/Recommendation #7: *Discussions with Farm Service Agency to allow buffer strips to be harvested to enhance edge of field mining of phosphorus should be continued.*

Discussion Points/Concerns:

- For more Farm Service Agency Information, see APPENDIX II.
- Formalize concerns to FSA via State Technical Committee.
- This special practice is allowed and successfully adopted in Grand Lake St. Mary watershed.
- Investigate what is needed to allow this practice statewide.
- Buffer strips should be harvested to remove nutrients away from the area where the buffer is designed to protect. Mowing and burning does not do this and will create more DRP on the surface. Harvesting should be incentivized.
- Harvesting of buffers is good for phosphorus nutrient management, but the primary consideration for establishing the buffer in the first place always needs consideration. Many were established for purposes other than water quality.
- This issue and the discussion points should reflect the important differences in design specifications between FOTG Standard 327-Conservation Cover and the better performing water quality practice FOTG Standard 393-Filter strip/Area.
- We support this concept, but make sure that strips are not allowed to be fertilized.
- Difference between mowing and harvesting
- Is it useable?
- Clarification on the impact on habitat, environmental and animal
- Concern over how does this impact phosphorus (mowing vs. burning
- Filter strips – need identified and follow NRCS standards

Issue/Recommendation #8: *Identifying how to fund or mix with research on NRCS edge of stream at Blanchard River project should be supported*

Discussion Points/Concerns:

- Should be under Research section for review
- Remove this suggestion; too specific as research should be much broader.
- This should be deleted. It is covered under Research Issue/Recommendation #4B.

Issue/Recommendation #9: *Regulatory options to address NPS pollution should be discussed now. Some form of regulatory approach may be needed in the event that initial voluntary efforts fail to meet reduction goals.*

Discussion Points/Concerns:

- Immediate steps are needed to educate, set reduction goals and create incentives to control nonpoint nutrient runoff.
- Establish a long range comprehensive strategy for nutrient management and regulation.

- Be mindful of long term goals – they should not conflict with ability to be modified as research changes.

Issue/Recommendation #10: *Efforts to reduce nutrient runoff should stress resource sustainability and provide incentives for producers embracing a whole farm planning concept.*

Discussion Points/Concerns:

Issue/Recommendation #11: *Encourage the installation of active and passive manure treatment systems in areas of intense livestock production.*

Discussion Points/Concerns:

Issue/Recommendation #12: *An incentive program should be established to support the adoption of innovative practices and year round treatment strategies.*

Discussion Points/Concerns:

- Who would manage the program?
- How would it be funded (fertilizer checkoff fee perhaps).
- What practices would be eligible and what incentives would be provided.

PRODUCTION

Issue/Recommendation #1: *Better nutrient management should be implemented to maintain and improve production while reducing off-site impacts and improving water quality.*

Discussion Points/Concerns:

- Education about how to improve nutrient management should be aggressively linked to economic outcomes for the producer. Goal: develop a worksheet that producers can use to calculate inputs and outputs (Pheasants Forever and EDF contractors have developed and used such worksheets for gauging the economic benefits of taking marginal land out of production - a similar worksheet could be developed for nutrient management outcomes).
- It is in the best interest of all farmers to evaluate the use and cost of their inputs and to evaluate where modifications could be made to enhance efficiencies.
- Realistic, practicable, measurable, research based nutrient management goals must be established.
- Formal linkage must be established between research, production and communication and outreach recommendations and activities.
- A matrix could be established to help here where required BMPs would be matched with different farm types.
- These three points would immediately and directly address major causes of P finding its way into surface waters:
    - No nutrient applications of any kind on snow covered or frozen ground unless incorporated, with emergency procedures implemented for qualifying exceptions.
    - No nutrients should be applied without a quality soil test or other documentation that substantiates application.
    - No "robo-recs" where soil tests come with a programmed recommendation that is inconsistent with good nutrient BMPs (such as programmed maintenance levels, or disregard for the P added in starter fertilizers).
- Which specific practices and measurements of those on such a wide diversity of farms.
- How to set goals and accomplishments?
- A goal would be to improve the efficiency of the manure and fertilizer usage and establish a suite of management and treatment practices (if needed) that would provide year round reductions of nutrient exports to levels that eliminate algae blooms, anoxia, and eutrophication in downstream waterbodies.
- Consider leased land – the education of landlords is incredibly important (not just farmers). This is important in the research section as well.

Issue/Recommendation #2: *The 4-R materials should be used as basis of guidance to producers, dealers and nutrient applicators.*

Discussion Points/Concerns:

- Support 4-Rs as part of education program.
- The 4Rs are very general guidance and only a starting point - actually, they need to be defined for each *operation*. A goal statement might be: Help producers across the state understand how to interpret the 4Rs for their operations, and help foster programs like adaptive management that provide the information the producer needs to put the 4Rs into action.
- The 4-R program is on the right track and makes a good sound bite, but what we need to be about is defining what "right" is.
- 4-Rs should be recommended for all nutrients, not just phosphorus.
- Good general guidance, but need to be more specific for Ohio.
- We need dissolved phosphorus BMP options.
- Right time, Right place, Right fertilizer source, Right rate might not go far enough. Need additional conservation practices, control and treatment of surface and subsurface water runoff off site.
    - Treatment needs to be defined (possible examples might be water control structures, treatment wetlands, two-stage ditches, natural channel design, and use of biofilters).

Issue/Recommendation #3 *Ohio's recommendations for the Right Rate of phosphorus should be based on:*

A. *Good soil test information*

OSU's recommendations of Soil Sampling and Tissue Testing* (SEE APPENDIX I)

Discussion Points/Concerns:

- These recommendations are in dire need of updating by a committee of agronomists looking at various sampling and analytical techniques relevant in Ohio.
- Soil test laboratories doing business in Ohio should be accredited and participate in the Performance Assessment Program (PAP) administered by the North American Proficiency Testing Program.
- Reporting of analytical data should be consistent in terms of units and substance tested in standardized form (e.g., P vs. P205, or lbs/acre vs. ppm).
- Concern with reporting soil test on GIS database for every farm/field for proprietary reasons (specifically privacy issues).

B. *Good Crop Recommendations*

OSU's Current Agronomic Recommendations** (SEE APPENDIX I)

Discussion Points/Concerns:

- These recommendations are in dire need of updating by a committee of agronomists looking at various sampling and analytical techniques relevant in Ohio.

- OSU current agronomic recommendations don't go high enough for today's crop yields. Corn recommendations need to accommodate yields of 275-300 bushels. Soybean recommendations need to accommodate yields of 85 bushels +. OSU recommendations need to accommodate the near term socioeconomic production culture to match the yield technologies that are driving rapidly increasing yields, in all Ohio crops.

C. *Equipment Maintenance and Calibration*

All application equipment should be well maintained and regularly calibrated to ensure accurate applications.

Discussion Points/Concerns:

- How do we keep "should" from becoming a "must"? Part of the licensing program? Look at ODA certified livestock management program as an example.

D. *Record Keeping*

Records should be kept for all soil tests, recommendations and applications as well as crops and yields being produced.

Discussion Points/Concerns:

- Needs to be an integral part of the NMP.

Discussion Points/Concerns:

- Establish at least one clear goal: for example; Implement training sessions for all producers, CCAs, fertilizer dealers and cooperatives in the state that establishes acceptable soil test methods (could be based on OSU guidelines or more advanced zone management methods) and instructs in how to read the results from the labs and *apply those results* in making fertilizer application decisions.
- Many questions have been raised about the appropriateness of current tri-state agronomic fertility recommendations.
- Coordination between research questions committee, CCAs, agronomists and university researchers needed.
- Lots of different methods for soil testing/sampling. Needs to be standardized as appropriate for the situation that needs to be identified in the testing BMP.
- Soil tests can have a lot of variability - by time of year, location, sample locations, number of cores collected to represent sample, depth of sample, etc.
- Soil tests should be required to be reported to state on GIS database for every farm/field.
    - Cannot require, but all tests have a sampling map that can be easily correlated to their location.
    - Reporting soil test data to the State would create a large data base. How will this data be effectively used and what is the cost of maintaining the data base?
- If soil tests are used to regulate, then sampling can be altered to give results needed.

    - Always a concern with those who choose to be dishonest. If the need for regulation is not warranted, this should not be an issue.
    - Unbiased group needs to come in and do sampling.
- Recommendations for crops were developed 40-50 years ago, under different genetics, yields, soil testing methods and production practice.
- Recommendations were developed under ideal conditions, not the soil and weather conditions of today.
- Recommendations have held up for today's yields and been verified by additional field research as recently as the late 1990s.
- Strict crop production recommendations could severely impact livestock producers.
    - Manured acres for the largest producers are already regulated, as they are in distressed watersheds. Due to economic considerations of applying manure nutrients by producers with limited options, BMPs specific to their situation can be developed that would better address the current situation.
- Nutrient stratification can be present and should be tested for, so future nutrient application methods could be changed to possibly reduce dissolved nutrient movement.
    - This information can aid in making important decisions about how to manage nutrients in the field in the future.
    - This bears further investigation, and should be under the research group.
- Questions about multiple crop rotation applications were raised vs. each crop.
    - This bears further investigation, and should be under the research group.
    - Phosphorus fertilizer application in a single year for one or more crops to follow may be OK if the fertilizer is placed by some method within the soil. It cannot just be left on the soil surface or atop crop residues.

Issue/Recommendation #4: *Ohio's recommendations for the Right Place of phosphorus should be based on:*

Since commercial phosphorus is treated to make nutrient more available (soluble) to the plants and manure often contains soluble phosphorus:

A.) Phosphorus applications should be injected or incorporated whenever possible.

B.) If surface applications are made, it should have a growing crop or cover as soon as possible.

Discussion Points/Concerns:

- "Whenever possible" and "as soon as possible," may weaken these two points so much that they are of no value.
- Evaluation of the current status of agribusiness structure and service delivery must take place in order to determine the ability to adjust.

- A cost analysis should be performed to quantify the cost differential between application methods (broadcast vs. soil incorporation). Incentives should be considered to encourage producers who follow the principles listed as A and B.

- Agreement with both A) and B) as good things to do, and A is unquestionably effective in reducing DRP losses that might result from fertilizer P application. However, placing statement B in this context implies that a cover crop or growing crop will reduce the impact of a broadcast surface application, and to my knowledge there is no evidence for that; in fact there is evidence that the increase in runoff DRP is just as great whether a cover crop is present or not.
- This recommendation should list statement A on its own, and then add to the list of discussion points the fact that the productivity and the ability to produce high yields of Ohio's heavy clay soils owes a lot to the fact that broadcasting makes possible more timely planting with less soil compaction. Thus alternatives to broadcast placement will not be simple and will require better technology (e.g. equipment to band-place P in no-till, perhaps in the fall) and more sophisticated strategies (e.g. closer watch to weather forecasts to ensure no broadcasting when heavy rains are possible within a week) than are commonly being used.
- Fate and transport mechanisms must be understood to ensure appropriate changes in placement are recommended.
- Change the discussion around incorporation: the goal is to apply to a growing crop (including cover crop) and/or to achieve soil contact. The discussion should not center around equipment, whether or not to incorporate and how much to incorporate. The discussion needs to be about soil condition and recoverability.
- Need research comparing incorporation techniques
- Agree with “A” above. Since P is relatively immobile in the soil, its utilization by plants is not very efficient as a surface applied material anyhow. Even with no-Till, P with a row starter or knifed in with sidedress application of N are easily accomplished.
- Don't forget the efficiency of banding either liquids or dry fertilizer materials. Helps lower fertilizer rates in some cases and increases the chance that the fertilizer will come into contact with soil.
- Options for in-soil fertilizer placement include pre-planting methods such as strip-till and deep banding, or through the planter methods such as in-furrow and row placement.
- Incorporate fertilizer at planting time with in-soil placement through planter equipment.
- Farmers own planters which have fertilizer placement capabilities or can be retrofitted to do fertilizer placement in the row at planting time.
- Limitations are present on the equipment availability for injection/incorporation. Most spreading equipment is bulk surface floater.
- Questions were raised about how much incorporation, what type of equipment, tillage benefits vs. erosion losses.

- Cost of Soluble Phosphorus losses are relatively small per acre vs. the cost of injection/incorporation. (Reduced/No tillage was quickly adopted because of economic/time benefits). Reduction of cost to the farmer should be identified.
- Cannot forget the offsite costs of dissolved phosphorus when it gets into streams or lakes.
- Changing the way dealers/applicators/farmers schedule nutrient applications so application can occur in conjunction with tillage/incorporation activities.
- Need better incentives and demonstrations for nutrient injection, strip fertilization/tillage, controlled traffic, RTK adoption.
    - This should be a priority area for incentives.

Issue/Recommendation #5 *Ohio's recommendations for Right Time should be:*

A. *Nutrients should not be applied to Frozen or Snow-covered ground.*
B. *Nutrients should be applied as close to crop utilization as possible.*
C. *Projected precipitation should be a factor and avoided*

Discussion Points/Concerns:

- "B" is generally a good recommendation to avoid nutrient loss (N) and take advantage of fertilizer solubility (P) that will diminish over time in contact with the soil. Large applications of K may be best further in advance of planting due to salt concerns. Situational specific.
- Regarding "C," the application of unincorporated nutrients right ahead of a major storm event or right before the ground thaws with a predicted rain event are good examples of poor nutrient management. Weather forecasts should be consulted and documented.
- Changing weather patterns have provided many challenges to farmers in recent years.
- Recognize that timing of nutrient application is important but must be careful not to limit the ability to farm.
- Everyone agreed that nutrients should not be surface applied to frozen or snow-covered ground.
- What's the definition of frozen and snow-covered? One definition: If nutrients can be injected/incorporated into the soil, then it would not be considered frozen or snow-covered.
- Limitations due to weather can interfere with applications.
- Restricting applications to all spring applied would not be practical. (Can't cover 4.5 million acres in 3 or 4 weeks with current equipment)
    - This is a challenge, but must be addressed in some fashion. The statement alone is not an excuse without researching the issue.
    - There is not sufficient time to apply all phosphorus fertilizers needed in the spring - at least not under our present methods of operation. Good fall

application options might include: banding of fertilizers; shallow to deep injection; incorporation with AerWay or similar tool, where not all crop residues on the soil surface will be lost via tillage.

- Questions about when heaviest storms occur, affecting soluble nutrient movement. Is fall better than spring?
    - Would be nutrient specific (N vs. P would be different, for example).
    - Need to determine which time frame is better.
- Need to look at controlled release materials.
    - For N, depending on application time and method.
- Weather (storm data)
    - When is it going to be the right time? Projected precipitation.
- Climate change data, what time frame is used? No harm in looking at data.
- Impact of dissolved phosphorus runoff in watershed\body.
- Make sure recommendation based on rainfall is reasonable.

Issue/Recommendation #6 *Ohio's recommendations for the Right Fertilizer source should be based on:*

Discussion Points/Concerns:

- The correct source is dependent upon the type of fertilizer used.

Issue/Recommendation #7 *In order to meet year round water quality improvements, surface and subsurface runoff reduction, management and treatment strategies should be addressed, including:*

A. *Repairs of broken subsurface drainage systems*

B. *Treating surface inlet runoff into subsurface drainage systems*

C. *Treating concentrated surface runoff areas*

D. *Controlled Drainage*

E. *Wetlands*

F. *Improved designed filter areas*

G. *Alternative drainage ditch designs*

Discussion Points/Concerns:

- All can be recommended practices as situational BMPs if fully researched.
- This is an important recommendation that should be stressed in the report. Some or all of these BMPs are likely to be as or more effective than the most commonly installed practice in northwest Ohio, the FOTG Standard 327 –Conservation Cover.

- Many of the BMP's listed are described and rated in the "DP BMP Toolbox" document prepared by Heidelberg University.
- Important to recognize that a systems approach is needed. Cookie cutter one size fits all solution will not be effective. Must have flexibility to utilize practices most appropriate to specific needs, abilities and characteristics of farm.
- Every treatment will not fit on every acre.
- Need better understanding of what is most effective.
- Costs of practices not well documented.

- Sometimes these practices need to be beyond individual crop farms boundary (more watershed).
- Fields that have a higher delivery of DRP should be addressed first.
    - Requires soil tests results from all fields.
- Wetland v. constructed treatment wetlands
- Setbacks from surface runoff.

Issue/Recommendation #8 *Targets/Goals/Measurements and Timelines should be set (example might be that all nutrient applications require a soil test, with all cropland acres being tested within 4 years).*

Discussion Points/Concerns:

- Example above should be 2 years at most.
- Depending on the management and cropping circumstance, 4 years between testing is too long an interval. A soil sampling history is what is important- looking at trends and consistency is much more meaningful than dependency on 1 year's test for 4 years.
- Soil testing at least every 3 years.
- Realistic, practicable, measurable, research based nutrient management goals must be established.
- Establish a tier of goals: for example, education and outreach goals might be structured around larger operators vs. smaller operators, livestock vs. row crop producers, independent CCAs vs. dealers, those participating in NRCS/FSA conservation programs vs. those who are not, producers vs. landowners.
- Establish incentives for producers to participate in meetings/trainings. For example, the adaptive management programs provide producers with a recent (Fall) digitally-enhanced aerial image of their operation, which provides a wealth of information to the producer, with experts helping to interpret the image. While this may not be feasible to do for every operation in the state, there may be other ways to attract producers to meetings with other types of information useful to them.

- Conduct surveys and focus groups in x # of watersheds by x date (the "questions committee mentioned in RESEARCH).
- Establish regional contests with cash prizes to the operator who optimizes nutrient management, soil and water conservation and economic management (with or without the help of USDA programs).
- Goals and recommendations need to be created.
- Incremental criteria should be used, and based on water quality attainment.
- Situational testing based on program used.

Issue/Recommendation #9: *Consider P,K ,N and soil conservation in overall analysis*

Discussion Points/Concerns:

- In most cases, these three nutrients need to be applied at different times to maximize availability to the intended crop.
- Important to remember that when talking about agricultural nutrients, it is more than just phosphorus. Each agricultural nutrient (N, P, K and micro-nutrients) must be considered.
- When can different agrichemicals, BMPs and treatment strategies be applied?
- Different applications times/rates depending on the area.
- Integrated solutions that address algae blooms, eutrophication, anoxia, sedimentation, and aquatic life in all receiving water bodies need to be developed.

Issue/Recommendation #10: *Need to investigate possibility of a statewide standard for soil testing and reporting of results to better ensure consistency and accuracy*.

Discussion Points/Concerns:

- Consider the proprietary/privacy concerns of producers. This topic addresses the lab consistency in the communications report protocol.
    - Consider that there are encryption tools available which can address privacy concerns.
- Producer should soil test before applying additional nutrients.
    - Concerns over the impracticality.
- Industry and university determined standards, long term, situational.

Issue/Recommendation #11: *The role of crop rotations, precision farming, intercropping, and cover crops should be addressed.*

Discussion Points/Concerns:

- Important to address that we cannot backslide on the issue of erosion control, while trying to achieve improvements in water quality management.

Issue/Recommendation #12: *Farmers should be incentivized to implement grid testing.*

Discussion Points/Concerns:

- Consider the funding source- who can/will pay for the incentive?
  - Consider the use of tax credits

APPENDIX I

Ohio State University Extension Recommendations

Dated: 1/24/2012

Soil Sampling

1) The basis of fertilizer application should be a representative soil sample from the target application site. Soil sampling should be used to monitor changes in soil test levels with a target of soil test Bray 1 Phosphorus levels in the 15 to 30 ppm range. If wheat or alfalfa is in the rotation then target ranges are 25-40 ppm. Specialty crops and other commercial crops may have differing soil test level needs that need to be considered.

2) Soil sample trends are as or more important than the single year test to validate fertility management programs. Soil management zones which can be based off soil type, topography or yield response maps provide a sound basis to develop a representative sample area. Collect 15 random cores at 8 inches deep from representative areas of the field. Area should be no larger than 25 acres unless a yield response criterion is used to determine the sample area. Bulk the collected cores in a suitable container, mix well then pull the appropriate size sample (usually 1 pint) for analysis. Submit the soil sample to a reputable lab for analysis. The better a sample represents the sample area the greater the confidence that appropriate fertilizer recommendations can be made. Grid Sampling is an alternative where point soil samples are collected at predetermined distances then through statistical process estimates of nutrients concentrations between the points are made.

3) Samples should be taken a minimum of every 4-5 years or once per rotation. More frequent sampling will be suggested where the soil test level of a nutrient is near the critical level. A 150 bushel corn crop removes (150 bushel * 0.37 Crop removal = 56 lbs). Phosphorus chemistry in the soil buffers the crop removal so that for each 15-20 lbs of P2O5 removal phosphorus levels in the soil are lowered 1 PPM. So our 150 bushel crop will lower the soil test at most 3 PPM.

Fertilizer rate recommendations

1) The purpose for a soil sample should be to generate a fertilizer recommendation. The Tri-State Fertilizer recommendations were generated using calibration studies with a Bray P1 soil test result.

   Fertilizer recommendations for corn (Table 1), soybeans (Table 2) and wheat (Table 3) are listed below. The tables are updated to reflect the higher yield potentials utilizing the equations from the Tri State Fertilizer Recommendations publication can be found at:

http://ohioline.osu.edu/e2567/index.html. The philosophy of these recommendations can be found in the original publication.

Table 1. Fertilizer P Recommendations for Corn. (adapted from Tri-state Fertilizer Recommendations for Corn, Soybeans, Wheat and Alfalfa)

	Realistic Yield Goal (bu/acre)						
Soil Test Level	120	145	170	200	225	250	275
PPM (lb/acre)	**lbs P_2O_5/acre recommended**						
5 (10)	95	105	115	125	135	145	155
10 (20)	70	80	90	100	110	120	125
15-30 (30-60)	45	55	65	75	85	95	100
35 (70)	20	25	30	40	45	50	50
40 (80)	0	0	0	0	0	0	0

Table 2. Fertilizer P Recommendations for Soybean. (adapted from Tri-state Fertilizer Recommendations for Corn, Soybeans, Wheat and Alfalfa)

	Realistic Yield Goal (bu/acre)						
Soil Test Level	30	40	50	60	70	80	90
PPM (lb/acre)	**lbs P_2O_5/acre recommended**						
5 (10)	75	80	90	100	105	115	125
10 (20)	50	55	65	75	80	90	100
15-30 (30-60)	25	30	40	50	55	65	70
35 (70)	10	15	25	25	30	35	35
40 (80)	0	0	0	0	0	0	0

Table 3. Fertilizer P Recommendations for Wheat. (adapted from Tri-state Fertilizer Recommendations for Corn, Soybeans, Wheat and Alfalfa)

	Realistic Yield Goal (bu/acre)					
Soil Test Level	50	65	80	95	110	125
PPM (lb/acre)	**lbs P_2O_5/acre recommended**					
15 (30)	80	90	100	110	120	130
20 (40)	55	65	75	85	95	105
25-40 (50-80)	30	40	50	60	70	80
45 (90)	15	20	25	30	35	40
50 (100)	0	0	0	0	0	0

For computer generated recommendations the following equations were used to generate the fertilizer recommendations in the tables.

BUILDUP EQUATION

for P: lb P_2O_5/A to apply = [(CL - STL) x 5] (YP x CR)

for K: lb K_2O/A to apply = [(CL - STL) x (1 + (0.05 x CEC))] + (YP x CR) + 20

MAINTENANCE EQUATION

for P: lb P_2O_5/A to apply = YP x CR

for K: lb K_2O/A to apply = (YP x CR) + 20 (for non-forage crops)

DRAWDOWN EQUATION

for P: lb P_2O_5/A to apply = (YP x CR) - [(YP x CR) x (STL - CL 15))/10]

for K: lb K_2O/A to apply = (YP x CR) + 20 - [((YP x CR) + 20) x (STL - (CL + 3O))/2O](for non-forage crops)

Note: The K maintenance and drawdown equation for forages. including corn silage, is

lb K_2O/A to apply [(YP x CR)+ 20] - [((YP x CR) + 20] x (STL-CL)/50]

where:

CL = critical soil test level (ppm)

STL = existing soil test level (ppm)

YP = crop yield potential (bu per acre for grains, tons per acre for forages)

CR = nutrient removed per unit yield (lb/unit)

CEC = soil cation exchange capacity (meq/100g)

APPENDIX II

New Discussion Points/Concerns from Ohio Farm Service Agency

Regulatory and Incentives

Issue/Recommendation #7: Discussion with Farm Service Agency to allow buffer strips to be harvested to enhance edge of field mining of phosphorus should be continued.

Discussion Points/Concerns:

- Difference between mowing and harvesting

Mowing:

For all CRP practices (including filter strips) (excluding grass waterways), periodic mowing is prohibited at all times, even if this activity is included in the conservation plan. Annual mowing of CRP for generic weed control is prohibited. Beyond the primary nesting season (March 1 –

July 15), occasional mowing for control of weeds, insects, or pests is permissible if included in the conservation plan. FSA County Committee may approve participant requests for spot mowing during the primary nesting season if untreated, the weeds, insects, or undesirable species would adversely impact the approved cover and the spot mowing is limited to the affected areas of the field.

For CRP filter strips designed under NRCS technical practice code 393, the filter strip shall not be mowed during the nesting season (March 1st through July 15th), unless the FSA County Committee approves a request from the participant for spot mowing as described above. Filter strips designed under 393 shall not be mowed after September 1st to allow for a good cover to establish prior to winter.

Harvesting:

If a filter strip is designed under NRCS technical practice code 327, harvesting of the acreage is not permissible at any time during the contract period. If a filter strip is designed under NRCS technical practice code 393, harvesting of the acreage may be permitted per NRCS standards according to the approved conservation plan. Planning of a filter strip under 393 must meet specific criteria set forth in NRCS standards. For CRP filter strips designed under 393, harvesting must be delayed until after July 15th. Filter strips designed under 393 shall not be harvested after September 1st to allow for a good cover to establish prior to winter. These specific timeframes in which harvesting may occur would most likely limit harvesting to one cutting per year.

Grazing shall not be permitted in the CRP filter strip designed under 393 unless a controlled grazing system is being implemented. Grazing will be permitted under a controlled grazing system only when soil moisture conditions support livestock traffic without excessive compaction. If a filter strip is designed under NRCS technical practice code 327, grazing of the acreage is not permissible at any time during the contract period.

- Is it useable

Material that is harvested from a CRP filter strip designed under 393 according to the approved conservation plan may be used for commercial purposes without penalty to the participant.

- Concern over how does this impact phosphorus (mowing vs. burning)

Mowing:

See *Mowing* above (difference between mowing and harvesting) for details on FSA and NRCS rules and regulations.

Burning:

In general, CRP filter strip may be burned if done under an approved burn plan prepared by a qualified individual. Certification under the Ohio Certified Prescribed Fire Manager program is strongly recommended. Prescribed burning may be conducted between July 16th and April 30th.

Prescribed burning shall not be performed in the following areas:

- Areas where burning will have minimal affect or potentially cause a negative impact on existing cover.
- Environmentally sensitive areas marked on the plan map.

ATTACHMENT D

The following comments and recommendations have been submitted for the directors' consideration by individuals or organizations who have participated in the working group. These invited comments were submitted independently of the meetings of the working group.

January 13, 2012

Michael D. Bailey, Executive Director
Office of Farmland Preservation &
Ohio Livestock Care Standards Board
Ohio Department of Agriculture
8995 E. Main Street
Reynoldsburg, OH 43068-3399

RE: *Recommendations for the Directors' Agricultural Nutrients and Water Quality Working Group (DANWQWG)*

Dear Director Bailey:

As representatives of tens of thousands of grain growers in the state, we write to offer some recommendations and comments for the Directors' Agricultural Nutrients and Water Quality Working Group (DANWQWG); specifically as it relates to the December 23rd Issues/Recommendations working document.

First, we would like to applaud you and all the participants of the working group for coming together to see if we can find ways to ensure higher quality waters throughout our great state, certainly a goal embraced by all. Additionally, it is encouraging to see that one aspect of water quality, phosphorous loading, has been steadily going down over the years recognizing the continual adaptation and conservation measures of our farmers. Naturally, our growers strive to protect the waterways in their backyards and seek to keep expensive products like phosphorous on their fields.

Since we all acknowledge that total phosphorous has in fact been going down in our watersheds, and we don't seem to have a good grasp on how dissolved reactive phosphorous (DRP) interacts with our water systems; we think it is fair to say that many serious questions remain to be answered. If phosphorous/DRP is leaving the farm, how is it happening? What farming and management practices are most effective in controlling any potential nutrient run-off? While our growers cannot control the ongoing phosphorous loading from the billions of gallons of untreated waste dumped from our state's combined sewer overflow problems or answer why algae blooms are occurring in areas with limited agricultural production, we are willing to step-up and research how the agricultural community can help answer some of the aforementioned questions.

With many questions in mind, our affiliated grower driven check-off organizations have already offered $500,000 towards a 3-year edge of field research project as spearheaded by Dr. Libby Dayton, a research scientist with The Ohio State University. The objective of this work is to validate, and as necessary, revise the Ohio Phosphorus Risk Index (Ohio P Index) by establishing field-scale, edge-of-field (EOF) monitoring facilities around Ohio. Data from these facilities will be used to 1) validate, and as necessary, revise the Ohio P Risk Index 2) Quantitatively, integrate additional best management practices (BMPs) into the Ohio P Index and 3) An online, web-based, interactive GIS tool will be developed and used to actively promote the revised/enhanced P Index.

Additionally, ongoing education must be a vital component shared by everyone. We pledge to diligently work to spread common sense messages such as the 4-Rs, recommend soil testing by all and promote the adoption of nutrient management plans (NRP) statewide. We also would be willing to discuss a certification program modeled after the pesticide program where certification would be renewed every 3 years for all applicators of fertilizer.

It is important for this working group to continue to offer a "shotgun" approach to best management practices and other recommendations as there remains much we don't know. Also, there is tremendous variability with farming throughout the state depending on your location, soil types, topography, etc. so we must be careful with blanket recommendations. Any recommendations must be science based and up to date since what we knew even 5 years ago about farming is not the same as what we know today.

Finally, we maintain that many of the suggestions in the working document need more research and validation before implementation, but still wanted to address several points more specifically. Please see the following bullet points referencing the DANWQWG working document from December 23rd:

<u>Research Section</u>:

- We are supportive of a sub-committee of DANWQWG to review research or as a "questions" committee, but want to make sure farmer representation is present; specifically grain farmers.
- We support Dr. Dayton's proposed edge of field testing program and updating and validating the P-Index and believe research dollars should be focused in this area
- Issue 5 Recommendations: Target Reduction Should Be Identified
    - Until we know how the DRP is leaving the farm, target reduction rates should not be arbitrarily set.
    - If reductions from all sources; how much assigned to agriculture?
    - What science backs up the recommendations?
- Windows and Weather:
    - Should not be a high priority; Ohio's weather too variable for specific windows
- OSU should place a high priority on hiring a fertility specialist with a specific focus on DRP, nutrients and production best management practices to better centralize and manage these issues (Robert Mullen's old position)

    - Fertility position should focus on water quality and updating Tri-State Fertilizer Recommendations
        - Tri-State Recs very outdated and do not reflect current farming practices, yields, etc.
- Measurements of Success:
    - Need to track and measure our goals; where did we start and what is our end goal?
    - How will that be quantified?
    - Measurements should be taken as close to the fields as possible and not just at Lake Erie

<u>Regulatory Section</u>:

- We strongly support better education (promote 4-Rs, soil testing and NMPs)
    - Stress economics: proper nutrient management plans save money
- Issue/Recommendation #2: Authority should be given to one of the agency directors to regulate the use of fertilizer
    - We oppose this as more research and understanding are needed
    - If we are not even sure of what should be the best management practices, how do we propose regulation?
    - How would a new regulatory program be funded? New taxes or fees on farmers?
        - Certainly these would raise serious concerns with our growers
- We would be open to discussing a certification program modeled after the pesticide program where a certification would be renewed every 3 years for all applicators of fertilizer
    - The Ohio Department of Agriculture would be the most appropriate agency to administer
    - Certification program could help promote best known management practices and help spread news of better BMPs as research suggests
- Issue/Recommendation #3: Need for ODA to collect better tonnage data and look at licensing structure of fertilizer manufacturers/distributors
    - Question the need for this, but supportive of gathering data at county level or by zip code
    - Not supportive of gathering on farm data for proprietary reasons
- Issue/Recommendation #4: Nutrient management plans should be required using NRCS 590/633 standards
    - NMPs should be encouraged, not required
    - More research needed as well; are NRCS 590/633 standards the most effective?
- Issue/Recommendation #5: CCAs' current mechanism to act as TSPs in developing nutrient management plans should be enhanced and simplified
    - Remove this suggestion; TSP program not workable
- Issue/Recommendation #6 : Communication with USDA/NRCS to streamline application processes for enrollment into CREP/EQIP programs should be supported
    - Remove this suggestion; CREP/EQIP are wrong targets
    - Too much funding uncertainty with these programs
- Issue/Recommendation #7: Discussions with Farm Service Agency to allow buffer strips to be harvested to enhance edge of field mining of phosphorous should be continued

    - We support this concept but make sure that strips are not allowed to be fertilized
- Issue/Recommendation #8: Identifying how to fund or mix with research on NRCS edge of stream at Blanchard River project should be supported
    - Remove this suggestion; too specific as research should be much broader

<u>Production Section</u>:

- Again, we are supportive of 4-Rs as part of education program
- Need to investigate possibility of a statewide standard for soil testing and reporting of results to better ensure consistency and accuracy
- Issue/Recommendation #3: Ohio's Recommendations for the Right Amount of Phosphorus
    - Not supportive of reporting soil test on GIS database for every farm/field for proprietary reasons
- 4-Rs should be recommended for all nutrients, not just phosphorus
- We support suggesting soil testing at least every 3 years

<u>Appendix</u>:

- Zone soil sampling is also appropriate; not just grid sampling
- Again, soil samples should be taken every 3 years instead of every 4
- Don't mix soil samples; leave samples intact for labs to ensure more accurate results
- Soil sample analysis should be done by a state certified lab, not a "reputable" lab
- Agronomic yield goals/recommendations should account for current yield trends (Corn 200, 220, or 240 bushels per acre for example)
- Wheat should be included in phosphorous recommendations

We stand ready to help answer any additional questions you might have and will continue to work with the DANWQWG and others to offer the best recommendations.

Thank you for your time and consideration.

Sincerely,

Mark Wachtman
President
Ohio Corn & Wheat Growers Association

Bret Davis
President
Ohio Soybean Association

Ohio AgriBusiness Association

January 25, 2012

Scott Nally, Director - Ohio Environmental Protection Agency
James Zehringer, Director - Ohio Department of Natural Resources
Tony Forshey, Interim Director - Ohio Department of Agriculture

Dear Directors:

I'd like to begin by commending you for establishing the Ag Nutrient and Water Quality Working Group to bring together stakeholders for the purpose of providing input on our water quality issues here in Ohio as it relates to phosphorous. The Ohio AgriBusiness Association (OABA) has participated since the beginning of this process and appreciates the open, transparent manner in which the discussions have taken place. OABA is a 130 year old agribusiness trade association that represents Ohio's fertilizer industry, along with the grain, feed, seed and crop protection product industries. Several of our member companies also participated in the Ag Nutrient Working Group, including; The Morral Companies, Crop Production Services and The Anderson's. We are affiliated with, and supportive of, our national and international partners; The Fertilizer Institute (TFI) and the International Plant Nutrition Institute (IPNI).

OABA recognizes the 4R Nutrient Stewardship program (nutrientstewardship.com) as the foundation for all other recommendations. The 4R nutrient stewardship provides a framework to achieve cropping system goals, such as increased production, increased farmer profitability, enhanced environmental protection and improved sustainability. To achieve those goals, the 4R concept incorporates the:

- **Right Source** at the
- **Right rate**, at the
- **Right time** and in the
- **Right place**.

Properly managed fertilizers support cropping systems that provide economic, social and environmental benefits. On the other hand, poorly managed nutrient applications can decrease profitability and increase nutrient losses, potentially degrading water and air.

OABA believes that education, communication and outreach can address the issues we are facing without unnecessary regulation. We also recognize the environmental and public health issues that the algal blooms cause and realize that time is of the essence in addressing the phosphorous issue. With that perspective, OABA and our participating member companies, offered many suggestions throughout the working

5151 Reed Road, Suite 126-C • Columbus, Ohio 43220 • Phone: 614.326.7520 • Fax: 614.326.7519

group process. We are willing to make some sacrifices for the common good, but these sacrifices should not be at the expense of being able to provide a valued and necessary service to Ohio farmers thereby restricting agricultural production that is so badly needed around the world.

As you consider your final recommendations to Governor Kasich, please keep in mind that one size does not fit all and flexibility is crucial to maintaining a viable agricultural industry while addressing environmental and water quality concerns. OABA appreciates the opportunity to provide formal input on the process and I thank you for the time and energy you and your staff put into this process. Please don't hesitate to contact me if you have questions or seek additional input.

Sincerely,

Christopher Henney

Christopher Henney
President/CEO

NATIONAL CENTER FOR WATER QUALITY RESEARCH

HEIDELBERG UNIVERSITY
www.ncwqr.heidelberg.edu
310 East Market Street
Tiffin, Ohio 44883-2462
Phone: 419.448.2198
Fax: 419.448.2345

January 27, 2012

Director Zehringer, Director Nally and Interim Director Forshey
Directors' Agricultural Nutrients and Water Quality Working Group
ODNR, OEPA, and ODA
State of Ohio

Dear Directors:

We commend you for the way you have responded to the report of the Ohio Lake Erie Phosphorus Task Force and to the worsening problems of harmful algal blooms in Ohio's surface waters. Furthermore, we stand ready to fully engage in efforts to move Ohio into a position of national leadership in addressing problems of nutrient runoff from contemporary agricultural production practices. Given the vulnerability of Lake Erie to nutrient impacts, and given the nature of Ohio's soil resources, we are fully aware of the challenges Ohio faces. Those same challenges present Ohio with not only the opportunity, but also the necessity, to become a national leader in minimizing adverse impacts of food production on water resources. The challenge is even greater in view of (1) the need to increase agricultural production and (2) the changes in climate that are exacerbating agricultural runoff.

The National Center for Water Quality Research at Heidelberg University is uniquely positioned to help Ohio become a leader in tackling this problem. Our tributary loading data sets, which combine high-frequency and long-term sampling for rivers that have various sizes, land uses, and soils, provide Ohio with nationally unparalleled information on baseline conditions and trends that enable problem identification and progress assessment. While much of our focus has been on tributary loading studies, our research studies and experience encompass phosphorus stratification in cropland soils, the movement of nutrient-laden runoff water into Lake Erie, and watershed modeling of phosphorus export through rivers. We also are involved in biological studies from ditches to rivers and bays and Lake Erie. Throughout our history, we have maintained an active "environmental extension" program wherein we directly convey our findings to local, regional and national audiences. These and other aspects of our program are described at our website: www.heidelberg.edu/NCWQR.

Achieving national leadership in this arena will require collaboration and cooperation among the multiple groups, including agricultural and environmental communities, related industries, government agencies, and research and extension universities. The NCWQR has an excellent record as both a participant in, and an organizer of, such collaborative and cooperative efforts. Since such efforts reflect the mission of our organization, you can count on us to help Ohio become a leader in addressing agriculture/water resource issues.

Sincerely,

Kenneth A. Krieger — David B. Baker — R. Peter Richards

Dr. Kenneth A. Krieger	Dr. David B. Baker	Dr. R. Peter Richards
Director	Senior Research Scientist	Senior Research Scientist

THE OHIO STATE UNIVERSITY

Ohio Sea Grant College Program

Franz Theodore Stone Laboratory
Great Lakes Aquatic Ecosystem Research Consortium (GLAERC)
Center for Lake Erie Area Research (CLEAR)
Area 100 Research Center
1314 Kinnear Road
Columbus, OH 43212-1156
Phone (614) 292-8949
Fax (614) 292-4364
www.ohioseagrant.osu.edu

27 January 2012

TO: Dr. Tony Forshey, Director, ODA
Scott Nally, Director, OEPA
James Zehringer, Director, ODNR

FROM: Jeffrey M. Reutter
Director

SUBJECT: Comments for Final Report of Directors' Agricultural Nutrients and Water Quality Work Group

Thank you for the opportunity to provide official comments for inclusion in the final report of the Directors' Agricultural Nutrients and Water Quality Work Group. I have very much appreciated the opportunity to participate on this group and have benefited from the experience. You and your staff members provided excellent leadership.

It is my understanding that the Governor wants recommendations that will solve the Harmful Algal Bloom (HAB) problem and protect the health of Ohio citizens and the coastal economy and do it in a way that minimizes costs. I support this 100% but am concerned that our Work Group didn't feel enough urgency. It might have helped if we had been instructed to come up with a plan that would reduce nutrient loading from agriculture to all tributaries in the state by 2/3 within a year. While this will be difficult, there are already businesses around Lake Erie and other Ohio water bodies that are closing, people who are losing jobs, and people who are experiencing health problems. I have led a group of scientists that have made recommendations, including recommendations for sewage treatment plants and other sources of dissolved phosphorus (P), which will accomplish this 2/3 reduction and solve the problem. I don't believe it is wise to delay action, but I do believe that the agriculture community, if appropriately motivated, could come up with even better recommendations and/or plans to evaluate other possible actions that could be equally beneficial but easier to implement. However, if our goal is to solve the problem now, we should implement the plan we have suggested and then do studies to develop and evaluate other strategies that could be more effective and less costly. If new and better strategies are developed in the future, they could be allowed as alternatives.

I am sure you all recognize this, but our group is only able to tell you how agriculture works and to discuss the pros and cons of various phosphorus reduction strategies related

to agriculture. Human nature should tell us that all we all tend to resist change and that this group is not likely to over emphasize the ease of implementing any change. As a result we heard of the difficulties for agricultural businesses, but we never heard from those non-agricultural businesses that are already closed or being adversely impacted. Furthermore, because our group somehow doubled in size over the course of our meetings, we began hearing more comments from people who had obviously missed the information we presented and discussed at the very beginning explaining new research results that had been obtained. As a result, in reading some of the comments that have come in on the draft report, it is clear that some people were ignorant of what we discussed and what we have learned in recent years.

I support voluntary measures, but we will need almost complete compliance to achieve the necessary reductions, and after listening to the group, I seriously doubt that it is likely to happen. If voluntary measures don't work in the first year, we should immediately move to regulations. I would also support immediately going to regulations particularly to get compliance on BMPs and require farmers to turn in records (what, when, how and with what fields are planted and fertilized) to the State Department of Agriculture. I am very disappointed that some feel we would have to pay farmers to get the records and I don't believe we can have a successful program without that information. Incentives can work, but the best incentive programs have equally effective disincentives. We must not forget this, and the disincentives (financial penalties are a good example) are also a good way to pay for the incentives.

We must strive to keep production high while reducing P runoff. This can be accomplished by modifying agricultural practices. If we don't modify agricultural practices, HABs will get worse and someone will die. We must stop trying to defend what we are doing by saying that food production is too important. Some of what we grow goes into ethanol production.

Below, I will provide some background on things we know and then comment on what we could to do solve the problem. I will be as brief as possible and will not attempt to explain the background justification for every point I make below.

- Lake Erie is the southernmost, shallowest, warmest, and most nutrient-enriched of the Great Lakes. These conditions allow for the growth of lots of rooted plants and algae, the algae supports lots of zooplankton, and the zooplankton supports lots of fish. As a result, Lake Erie often produces more fish for human consumption than the other four Great Lakes combined. But it is possible to have too much of a good thing and that occurs when we put too many nutrients into the Lake. The result is excessively large algal blooms.
- There are 6-7 forms of blue-green algae or cyanobacteria that can bloom when phosphorus concentrations are too high. These are warm water forms, so we can expect to see these HABs during the summer and fall.
- The limiting nutrient is typically P. The bioavailable form or P is called dissolved P or soluble reactive P. This is the form of P that concerns us the most.

- Concentrations of dissolved P in Lake Erie and loadings of dissolved P to Lake Erie have been increasing since the mid-90s and we are now back to the levels we experienced on Lake Erie during the "dead lake" years in the 1960s and 70s.
- In the 60s and 70s the P came primarily from point sources. We reduced loading by 2/3 and the dead lake became the walleye capital of the world and over 1300 new Lake Erie businesses were developed. It should be noted that the proposed 2/3 reduction in dissolved P loading to Lake Erie will not bring the lake back to pristine conditions, but I don't believe that is a reasonable goal anyway . I do believe that a 2/3 reduction in loading of P will produce a Lake that is similar to what we had in the early 90s.
- Today, P levels have returned to 1970s levels, agricultural loading is the dominant source, and again loading of P needs to be reduced by 2/3 to eliminate the HABs.
- The Maumee River puts in some of the largest loads of P and the greatest concentrations of P.
- Historically, we have said that P stays on the land unless it attaches to soil particles and erodes off the surface, and that nitrogen dissolves in water. We now know that P also dissolves in water and runoffs that way. We also know that approximately half the dissolved P coming off a field is coming out of the tiles.
- Approximately 30% of the land in Ohio already has too much P on it.
- We need to prevent P and N applications in the fall and winter, especially on frozen ground.
- P should never be applied at levels above agronomic needs as defined by OSU. This means we have to get soil tests for all fields and we have to test all manure applications to be sure we know what nutrients the manure contains.
- HABs in Lake Erie in 2011 were 2.5 worse than the previous highs during the 21st century. They also expanded into the Central Basin in October in a way we have never seen even going back to the 1930s and 1960s.
- In 2011, the concentrations of the algal toxin, microcystin, were 1200 times the level recommended by the World Health Organization for drinking water.
- Incorporating P into the soil reduces runoff of dissolved P by over 50%. We must stop applying P at the surface without immediate incorporation. It would not be the end of the world if we said that no P could be broadcast. Furthermore, many people believe that a year without fertilizer additions would not be catastrophic.
- Most nutrients leave fields and enter streams during runoff events. Therefore, wet years are going to be more of a problem than dry years. We must develop policies that protect our waters even during wet years.
- While many groups are working in the watershed, no group has a data set as long or as complete as Heidelberg's. We must keep that in-stream monitoring going and expand it to be able to measure the effectiveness of any measures we implement.
- While we need to reduce loading from sewage treatment plants, the vast majority of the work needs to be done by agriculture. Funding from the state to cover the cost of additional alum treatments at sewage treatment plants could be beneficial.

Thanks for the opportunity to comment.

Jeff

OHIO FARM BUREAU

Forging a partnership between farmers and consumers
• Working together for Ohio's farmers •

January 27, 2012

Dr. Tony Forshey, Interim Director, ODA
James Zehringer, Director, ODNR
Scott Nally, Director OEPA

RE: Recommendations for the Directors' Agricultural Nutrients and Water Quality Working Group

Dear Directors Forshey, Zehringer and Nally:

The Ohio Farm Bureau Federation (OFBF) would like to thank you for the opportunity to participate in the Directors' Agricultural Nutrients and Water Quality Working Group (DANWQWG) as well as provide comments and recommendations to be included in the final report.

OFBF is the largest voluntary nonprofit agricultural organization in the state of Ohio. Our members produce virtually every kind of agricultural commodity and as a result, OFBF is strongly interested in the protection of Ohio's natural resources (soil, water and air). OFBF policies are based on the fundamental principles of protecting private property rights, ensuring that environmental policies and programs are based on the collection and analysis of sound scientific data and whenever possible, ensuring that environmental and conservation programs are voluntary, cost-effective and allow flexibility to meet the specific needs of the farmer.

Throughout the meetings of DANWQWG two items were made very clear – the weather is unpredictable presenting many challenges to Ohio's farmers and there are many unanswered questions related to the fate, transport, control and ecological impact of dissolved reactive phosphorus. The unpredictability of the weather and the unanswered questions emphasizes the need for flexibility. Rigid one size fits all solutions are not appropriate. Focused research is critical to the development and implementation of cost-effective practical solutions. Recognizing that research takes time, establishing an adaptive management based strategy incorporating the ability to change as new information becomes available will be critical to successful implementation.

OFBF specific comments for your consideration:

Not a Consensus Based Process

The process used to develop and generate this report was never designed and should not be viewed as a consensus based process. The over 120 working group members began meeting in late August 2011 to discuss and develop a comprehensive set of action steps to address agriculture's cumulative impact on water quality. The product of the DANWQWQ is a 36 page document containing 43 identified Issues/Recommendations. It is important to point out that while all of these items were openly discussed, they should be considered a "laundry list" and not a consensus of the working group members. OFBF does not support all of the 43 identified Issues/Recommendations and associated Discussion Points/Concerns.

280 N. High Street • P.O. Box 182383 • Columbus, Ohio 43218-2383
Phone: 614.249.2400 • Fax: 614.249.2200 • Web site: www.ofbf.org

Education, Communication, Outreach

The development and implementation of a structured focused education/outreach campaign is essential to the success of an agricultural nutrient management program. A recently published research study by Kenneth Genskow in the January/February 2012 issue of the Journal of Soil and Water Conservation documented that after farmers in Wisconsin had the opportunity to participate in a multisession educational workshop series focused on understanding and developing nutrient management plans (NMPs), a high percentage (82%) are following their NMP on most of their land up to three years after taking the workshops. Focused, targeted, interactive educational programs work and should be pursued. Identifying the agency or group to lead this effort as well as establishing a fair and equitable funding source is also essential to its success.

Reference: Genskow, Kenneth. 2012. Taking stock of voluntary nutrient management: Measuring and tracking change. Journal of Soil and Water Conservation 67(1):51-58.

Dissolved Reactive Phosphorus Reduction Target

Presentations and discussions taking place during the meetings of the DANWQWG have helped to establish the following:

- In recent years, the amount of dissolved reactive phosphorus (the form most readily available for plants to use to grow) being delivered to Lake Erie from a variety of sources has been increasing. Unfortunately, the reasons for the observed increase are uncertain.
- The increase in the dissolved reactive phosphorus load to Lake Erie has resulted in an increase in the number and areal extent of algal blooms.
- The mechanism(s) and pathways for dissolved reactive phosphorus transport are not well understood by the research community.
- Non-native invasive aquatic species accidentally introduced into Lake Erie have created a new dynamic ecosystem with fundamentally altered nutrient and energy pathways.
- It is clear that increased research and monitoring efforts are needed to better understand the changes in the nutrient dynamics and lake ecosystem changes.
- Weather patterns have been changing. We are experiencing more intense rainfall events resulting in increased peaks in surface runoff and increased volumes of wastewater being discharged to surface water via combined storm sewer overflows (CSOs) and sanitary sewer overflows (SSOs).
- Point and nonpoint sources contribute to the dissolved reactive phosphorus load to Lake Erie.

The many uncertainties identified above raises several questions about the ability to establish a practical realistic cost-effective regulatory dissolved reactive phosphorus load reduction target that will provide the desired ecological end point. Until reliable predictive ecological cause-effect models become available, program planning targets could be established as long as the reduction target is applicable to all sources of phosphorus and the target is based on realistic expectations of anticipated ecological response.

Better Decision Making Tools

Discussions taking place during the DANWQWG meetings highlighted the need to develop better decision making tools. Over the years, Ohio's agricultural community has demonstrated time and time again it is willing to do what is necessary to meet our natural resource challenges. Be it the Dust Bowl days of the 1930s, the Lake Erie phosphorus reduction activities of the 1980s or addressing the Lake Erie water quality challenges of today, Ohio agriculture is willing to do its part. The outstanding questions are, "What should farmers do?" and "Where should they do it?" Supporting many of the identified research needs will go a long way toward the development of better decision making tools for farmers, politicians and decision makers.

Adaptive Management

Ohio's agricultural community recognizes that they have a role to play in addressing the surface water quality concerns facing Ohio and cannot sit idly by and not take action. The development and implementation of nutrient management plans (NMPs) are a good first step. OFBF and our members have recognized the importance of agricultural nutrient management and have adopted several policies through our grassroots policy development process related to it.

OFBF Policies:

- Expect all farmers, regardless of size of their operation, to use environmental management systems to protect and improve water quality as well as complete and follow a comprehensive nutrient management plan.
- Support legislation that provides a safe harbor for farmers who follow industry accepted practices for nutrient management.
- Encourages all those (including non-agricultural) applying nutrients and crop protectant products to follow recognized management practices including the development of nutrient management plans with soil testing.
- Encourages continued research and use of sound conservation practices designed to minimize the offsite transport of nutrients from the application of manure and encourage the adoption of practices suitable for application on frozen and snow-covered ground to protect surface and ground water resources.
- Considers all sources of nutrients (organic and inorganic) equal and should be treated the same.
- Do not support a requirement that farmers must obtain a permit to apply lime, fertilizer or other nutrient inputs.

Given the variability (soils, topography, crops, weather, etc.) across Ohio, it is recognized that no single management measure by itself will be the sole solution. A combination of management measures implemented in concert with NMPs will be needed. A priority action should be the establishment of an adaptive management process whereby the information obtained as an outgrowth of the research recommendations will be put into action and incorporated into improved decision making tools. The goal being the ability to provide farmers with the ability to select a practical cost-effective system of integrated management measures best suited for their farm.

Ability to Farm

Ohio's ever changing weather patterns provide numerous challenges for farmers. Excessive spring rainfall delays planting, wet conditions in the fall delay harvest, dry conditions in the summer reduces crop growth and yield. Working the fields when they are wet reduces soil quality and increases soil compaction. Identifying the most appropriate times of the year to conduct farming practices (prepare seed bed; plant crops; apply nutrients, soil amendments and crop protectants; harvest crops; etc.) to protect water quality is laudable but establishing activity restrictions is not practicable. Farmers must continuously modify their day-to-day management plans and adapt to current conditions. Placing time restrictions on farming activities reduces the ability of farmers to farm and produce crops at levels that allow them to sustain a living and hopefully make a profit.

The challenge facing Ohio farmers, politicians and decision makers is striking a balance between maintaining agricultural production at the levels needed to help feed the world, ensure a sustainable economically viable agbioresource industry and positively impacting our natural resources. As stated on page 79 of the Draft Nutrient Reduction Strategy Framework for Ohio Waters prepared by Ohio EPA with contributions from ODA and ODNR (November 15, 2011):

> *"The task ahead is to find cost effective means to reduce the delivery of nutrients present in point source effluents and in NPS runoff from urban and agricultural land use. And this must occur in a manner that does not interfere with Ohio's overall economic recovery."*

We must keep farmers farming and not place impractical onerous restrictions and conditions on them that cause them to go out of business.

It is important that the final document contains a formal introduction to set the stage for the information that follows in the report. The DANWQWG members have the common understanding that the recommendations being proposed are solely addressing agriculture but a nonparticipating reader will not. Inclusion of a formal introduction will prevent possible misrepresentation of the document and its content outside of the DANWQWG. The bulleted items presented previously under the dissolved reactive phosphorus reduction target heading are suggested content for the introduction.

Thank you for considering these comments. The OFBF understands the importance of protecting the quality of our water resources. Our policies are based on the fundamental principles of protecting private property rights, that environmental policies and programs must be based on the collection and analysis of sound scientific data and that environmental and conservation programs should be voluntary, cost-effective and allow flexibility to meet the specific needs of the farmer. We support the development and use of nutrient management plans and we will do our part to ensure their development while protecting the vitality of Ohio Agriculture.

We look forward to our continued involvement in the development and implementation of solutions to this important issue. If you have any questions do not hesitate to contact Adam Sharp, Vice President Public Policy (614-246-8250) or Dr. Larry Antosch, Senior Director Policy Development and Environmental Policy (614-246-8264).

Sincerely,

John C. Fisher
Executive Vice President

cpy: OFBF Board and Cabinet

The Nature Conservancy
Protecting nature. Preserving life.™

The Nature Conservancy in Ohio
6375 Riverside Drive, Suite 100
Dublin, Ohio 43017

Tel (614) 717-2770
Fax (614) 717-2777

nature.org/ohio

Directors Forshey, Nally and Zehringer *via* January 27, 2012
Mike Bailey
Executive Director
Office of Farmland Preservation & Ohio Livestock Care Standards Board
Ohio Department of Agriculture
8995 E. Main Street
Reynoldsburg, Ohio 43068-3399

Dear Ohio Directors of Agriculture, Environmental Protection, and Natural Resources:

Thank you for the opportunity to provide our views on the important work of your Agricultural Nutrient and Water Quality Working Groups, and on the recommendations that they will help to inform. Working together we can find a way to achieve both a healthy agricultural economy and healthy waters in Ohio.

The Nature Conservancy would like to commend the Directors on their solutions-oriented approach to our shared water quality concerns, the cooperation between agencies, and the inclusiveness of participants with an array of perspectives and interests. We are also encouraged by many of the constructive thoughts and ideas discussed in the Working Groups over the last several months. We have been particularly impressed with the support for 4R nutrient management reflected in the meetings and notes.

One of the most significant achievements of the working groups so far has been the agreement that agricultural practices are contributing to water quality problems, and the commitment to working together to solve these problems. While we are encouraged by the conversations and progress, there is still a lot of work to be done. In particular, there are still questions about what, where, and how we will work together to achieve the agricultural and water quality goals in Ohio.

To be successful, the Governor's program will need to have explicit goals and a vision of what success looks like, set accountability for progress, and prioritize where and how to work to achieve goals. To these ends we recommend that:

- *Long-term lake and stream water quality goals, and interim milestones are set as soon as possible, based on best available science and knowledge. These goals should be reconsidered periodically and updated to reflect improvements in science and understanding.*
- *All major programs proposed to the Governor include explicit ways to measure success, focused on environmental improvements in streams and in Lake Erie when possible.*

100% post-consumer materials

Accountability for progress should be emphasized, with adaptation of approaches required if progress does not keep pace with milestones. Authority should be given to one of the agencies to regulate the use of fertilizers in case that becomes necessary.

- *A Goals and Accountability working group be developed, and charged with developing an accountability framework and budget within 6 months.*
- *An ODA-endorsed, voluntary best practice nutrient and water quality certification program be developed, with potential certification opportunities for retailers and farmers. As a part of this, a small Certification Working Group should be launched, with a representative of agricultural retail, farmers, environmental NGOs, and the public sector participating. Certification standards should be developed by April, 2013.*
- *The most effective incentives and disincentives be identified, and supported through legislation or other mechanisms. Targeting should be used to direct resources to problem areas, or areas of opportunity, to make limited resources go farther toward meeting environmental outcomes. To move this goal forward, a small Incentives Working Group should be launched with representatives of agricultural retail, farmers, environmental NGOs, universities, and the public sector participating and initial recommendations due within 6 months.*
- *A nutrient reduction research committee comprised of agency staff, researchers, producer group reps, and NGOs be established to help develop needed research RFPs and coordinate potential research within OH and across state lines if needed. Initial priorities would be to identify what prediction capabilities need to be enhanced (e.g., identification of key contributing lands), evaluation of the cost-benefit of management practice implementation on water quality, estimation of total N & P loads to Lake Erie and corresponding Lake TMDL, and how to encourage and increase adoption of precision agriculture.*

More information and context for these priority recommendations is included below. We hope that these will be of use as this work moves towards its next phase. We have also developed more detailed descriptions of these ideas, which we would be happy to share upon request.

If you have any questions, please do not hesitate to contact me by email (jknights@tnc.org) or by phone (614)717-2770 xtn 126. Thanks again.

Sincerely,

Josh Knights
State Director

cc: Bill Stanley, Carrie Vollmer-Sanders, Anthony Sasson, John Stark

Summary of The Nature Conservancy's Priority Recommendations
January 27, 2012

Goals and Accountability

Goals

Before deciding the best ways to proceed, and how to gauge progress, some general goals need to be established. Our general vision is that Ohio will attain high water quality while maintaining a healthy agricultural economy.

We recommend that long-term lake and stream water quality goals, and interim milestones are set as soon as possible, based on best available science and knowledge. These goals should be reconsidered periodically and updated to reflect improvements in science and understanding.

For the sake of discussion, a long term goal could be to meet Ohio EPA's TMDL goals, which vary from one watershed to the next. For example, they may call for total P reductions ranging from 20% to 90%. The types of change in agricultural management needed to meet these goals range from better nutrient management to floodplain restoration and management.

Another goal would be to maintain healthy lakes throughout the state, eliminating harmful algal blooms. Meeting TMDL goals would help many lakes. But to maintain a healthy Lake Erie, scientific estimates are that at least a 50% reduction in dissolved reactive phosphorous is needed.[1] For the sake of discussion, we recommend that a 50% reduction in dissolved reactive P delivery to Lake Erie be one goal. Additional goals for other nutrients, beyond those described in the TMDLs are also needed.

Accountability

Achieving these goals would likely require a decade or more, rather than just a few years. Milestones toward long term goals need to be developed, with measurements and monitoring conducted over time.

If progress toward goals over time is not acceptable, programs that are designed to drive implementation may need to be revised or new ways of making progress identified. For example, if too few managers are engaging in activities that will reduce nutrients, incentives may need to be refocused or increased. Or, where voluntary programs prove to be ineffective, regulatory approaches may need to be considered or automatically triggered.

We recommend that all major programs proposed to the Governor include explicit ways to measure success, focused on environmental improvements in streams and in Lake Erie when possible. Accountability for progress should be emphasized, with adaptation of approaches

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[1] Jeff Reutter, presentation at State of the Lakes Ecosystem Conference (SOLEC), 2011.

required if progress does not keep pace with milestones. Authority should be given to one of the agencies to regulate the use of fertilizers in case that becomes necessary.

In terms of how to measure progress, levels of funding, acres under management, and other *activities*, should be considered as indicators. The development of needed research, changes in management practices, and other *outputs* are also useful indicators.

But while *activities* and *outputs* are helpful indicators of progress, neither is adequate to provide accountability to environmental *outcomes*. The most important measures of success will be around actual environmental improvements in streams and lakes. Monitoring things like nutrient runoff, dissolved phosphorus, and biological endpoints will be important. Outcome goals and monitoring are needed related to water quality, nutrient runoff, phosphorus loads, and biological endpoints (e.g., Harmful Algal Blooms and fish community health).

We recommend that a Goals and Accountability working group be developed, and charged with developing an accountability framework and budget with their recommendations due within 6 months.

This working group should include representation from public agencies, environmental NGOs, Universities, and agricultural business or farmers. To be cost-effective, measures should, as far as possible, build or borrow from existing measurement efforts already funded under current programs.

Voluntary Certification

Voluntary certification is common in other sectors, including all kinds of industry, forestry and some agriculture. [2] Typical to these programs is the development of an agreed upon set of standards that an entity needs to meet to achieve certification. Third-party evaluators generally compare actual management against the standards, provide feedback on what, if anything needs to be changed to meet standards, and when satisfied issues a report recommending certification to a governing body.

We recommend that an ODA-endorsed, voluntary best practice nutrient and water quality certification program be developed, with potential certification opportunities for retailers and farmers. As a part of this, a small Certification Working Group should be launched, with a representative of agricultural retail, farmers, environmental NGOs, universities, and the public sector participating. Certification standards should be developed by April, 2013.

The group would first be charged with developing a set of certification standards, aimed at reducing agricultural nutrient and water quality problems, to be used in certifying agricultural retailers. Additional programs, targeted for Farmers, or groups of Farmers, could be considered in the future. The first set of standards would need to consider public comments and input.

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[2] For examples, see ISO standards and certification programs, MAEAP, FSC and SFI.

Retailers who implemented defined practices, and were then determined to be in compliance with standards by third-party verifiers, would be able to advertise themselves as certified retailers. Certification could provide increased access to certain markets or be a prerequisite to gaining access to other incentive programs. Practices required for certification should also be supported by incentives, many of which are described next.

Incentives

Current incentives have not initiated the right management and conservation practices in the right places at the scale necessary to decrease the nutrients in our rivers and streams. Because the problem of water quality is so large, the full force of incentives to affect change may be required to make progress. These incentives may include items such as tax policy, staff training, cost-share, interest rate reductions, infrastructure alternatives, public policy, and grants and loans. Disincentives such as tax policy, fees, public policy and regulation can also be effective in driving action.

In considering which incentives to support, and where to focus them, targeting should be taken into account. The amount of nutrients that various practices and watersheds are contributing to streams and lakes varies across the state. SWAT, SPARROW, TMDLs, and other approaches are effective in identifying the differences. Combined with information on the most cost-effective activities to undertake, Farm Bill and other incentive programs and activities can be better focused for improved outcomes.

We recommend that the most effective incentives and disincentives be identified, and supported through legislation or other mechanisms. Targeting should be used to direct resources to problem areas, or areas of opportunity, to make limited resources go farther toward meeting environmental outcomes. To move this goal forward, a small Incentives Working Group should be launched with representatives of agricultural retail, farmers, environmental NGOs, and the public sector participating and initial recommendations due within 6 months.

Below are examples of non-regulatory incentives and disincentives that could support management and conservation that will lead to higher water quality. Administration of any of these items would need to be streamlined. Some incentives exist that seem to be the right incentives, but because it is so difficult to participate, they rarely get applied and are therefore ineffective.

Incentives:

- Tax policy – The federal accelerated depreciation schedule for farm equipment will phase out this year, implementing a state accelerated schedule for specific items that are most beneficial to nutrient management may incentivize purchasing the equipment sooner. If agricultural retailers need to hire additional seasonal, educated staff to help

apply nutrients at the right time lowering the state income tax withholding or allowing for a credit may help those entities hire competent staff.

- Staff training – For a set amount of time, 2 years for example, any CCA, agricultural retail employee, nutrient applicator or landowner, or farmer could receive college credits, CCA credits, or fertilizer application certification once coursework was completed on nutrient and water quality management. This training could be done regionally and online at a substantially discounted cost. The same information should continue to be offered, but at the normal rate for training, $259 per credit hour at OSU, for example.
- Cost-share – NRCS has cost-share for farmers currently. This federal program has helped implement conservation and is often cumbersome to be a part of due to contractual agreement criteria with the Federal Government. Supporting a state or county-level cost-share program, funded by the fertilizer fee perhaps, could allow for more specific and faster adoption of new technology cost-share. This would only work if the administration of such programs was streamlined and efficiencies were realized.
- Interest rate reductions – This incentive currently exists but is cumbersome, thus underutilized. Interest rate reductions or buy-downs could be used on all types of conservation implementation including equipment purchases, fertilizer storage, and cover crop planting.
- Infrastructure alternatives – Drainage law is unwieldy and change is made often at the discretion of the county engineer. Currently landowners are allowed a ditch assessment credit if they have filter strips along the stream/ditch. Often these requests are denied by the county engineer even though they are in law. These assessment credits and approval should be reassessed and expanded to include additional proven conservation practices such French drains/blind inlets and two-stage ditch designs.
- Public policy - If 4R certification or some comparable assurance were implemented, an affirmative defense could be available for those entities that were certified. In which case if there were water quality nutrient standards or the watershed was deemed to be a TMDL, the entity would be considered in compliance with those standards and afforded affirmative defense if they were following the 4R certification requirements.
- Grants – Grants and loans could be used to help farmers conduct water quality testing at the end of their tile drains to gain information and adapt management practices accordingly. Implementing tile drain management changes could be part of the more local cost-share pool. Funding for these could come from a variety of sources, including nutrient fees.

Disincentives:

- Tax policy – If a landowner does not implement a specific number of best management practices from a list of approved practices, the CAUV, differential real estate tax assessment would not be applied until the practices were in place.
- Fees – Fees could be applied to fertilizer dealers, applicators or CCA's unless they participated in specific education or followed specific recommendations. Fee receipts could be used for education, research grants, or other uses related to agriculture and water quality.

- Certified Crop Adviser – If a person holding the CCA accreditation does not complete Ohio specific classes on nutrient and water quality management, thus gaining training in the dissolved phosphorus discussion, (s)he would lose their CCA accreditation.

Research

A considerable number of nutrient reduction modeling and research efforts have been undertaken but informational gaps still exist, particularly in the dynamics of nutrient transport, and determination of key contributing lands. Although enough information exists to develop initial targets for N & P reduction it is clear that more information on nutrient cycling and loading mechanisms will be helpful to refine the ultimate reduction levels that will be needed to ensure the sustainability of Lake Erie and its stream network. In order to best utilize scarce funding resources and make quick progress toward needed knowledge, a coordinated research approach must be taken.

Below are a few top-line research recommendations:

- A nutrient reduction research committee comprised of agency staff (both Ag production and aquatic ecology), researchers, producer group reps, and NGOs should be established to help develop needed research RFPs and coordinate potential research within OH and across state lines if needed.

- Initial research needs to identify what prediction capabilities need to be enhanced (e.g., identification of critical management areas in crop fields, identification of critical portions of watersheds (key contributing lands), evaluation of the impact of management practice implementation on water quality, and estimation of total N & P loads to Lake Erie and corresponding *Lake TMDL.*

- Research should be immediately directed toward precision agriculture, including best practices for use and how to increase adoption. This concept should be supported by agriculture because it is 1) production-oriented, 2) likely to have cost savings, and 3) save nutrients for the future. It's a "pollution prevention" approach, and works to save nutrients for later use, rather than treat and dispose of them. It also avoids overloading buffers, channels and any BMPs with nutrients.

In summary, for research:

We recommend that a nutrient reduction research committee comprised of agency staff, researchers, producer group reps, and NGOs be established to help develop needed research RFPs and coordinate potential research within OH and across state lines if needed. Initial priorities would be to identify what prediction capabilities need to be enhanced (e.g., identification of key contributing lands), evaluation of the cost-benefit of management practice

implementation on water quality, estimation of total N & P loads to Lake Erie and corresponding Lake TMDL, and how to encourage and increase adoption of precision agriculture.

Please contact:

Josh Knights (614)717-2770 xtn 126, or Bill Stanley (bstanley@tnc.org), (614)717-2770 xtn 137 with any questions.

Ohio Environmental Council

[UNLEASHING THE POWER OF GREEN]

1207 Grandview Avenue, Suite 201 (614) 487-7506
Columbus, Ohio 43212 www.theOEC.org

Director's Agricultural Nutrients and Water Quality Work Group,
Mike Bailey, Director

January 27, 2012

We sincerely appreciate the interest and engagement by Directors, Zehringer, Nally and Forshey in this issue. We fully agree that it is both wise and prudent to for Ohio to develop effective measures to control nutrient run off from farms in order to preserve water quality and save dollars on the farms. We appreciate the honest and inclusive process and trust that it will lead to an effective set of recommendations.

We also appreciate the initiatives already taken by agencies, institutions and stakeholder groups. The 4 Rs program will be a very useful component of the overall solution.

We firmly believe, however that additional actions will be needed to achieve the necessary reductions in nutrient loads leaving farms. All stakeholders agree that education should be the foundation of the overall program, but we must also acknowledge that any effective program must be adopted by a vast majority of operators if sufficient reductions are to be achieved. In order to accomplish this, we believe that some target and limited regulatory initiatives will be needed;

1. We urge the Directors to support legislative changes that would enable the Department of Agriculture to regulate the use (application) of chemical fertilizers and manure on Ohio's farms. Such a change, would enable the Department of Agriculture to establish a nutrient management certification system, like that recently adopted by Indiana, or that currently used for pesticides here in Ohio.
2. We also urge legislative changes to establish a fee for the application of fertilizers, including manure. Such a fee could be administered in a way to be credited back to farmers or farm supply companies, who used approved practices (such as the 4 Rs). A fee configured in this manner, could change farmers behavior and create a revenue stream to cover administrative costs.
3. In order to be able to measure progress, we urge State agencies to establish a statewide web-based data platform for soil tests, as well as cropping and yield data. Such a system would be accessible (via a unique access code) by farmers and crop advisors, for use as a record keeping

system. Each soil testing lab operating in Ohio could link directly to the service, and an interface could be offered for GIS guided, application systems.

4. We also recommend the continued use of the distressed watershed rule by ODNR. This rule will only be triggered when needed, in watersheds that are impaired or distressed, and will require an added measure of accountability by farmers and crop advisors in the area. In order to adequately determine the impairment status of any given watershed, state and federal resources should be devoted to establishment of measurement and monitoring tools and programs, which accurately and reliably determine water quality.

We firmly believe in trusting farmers and farm supply businesses to act responsibly, and in providing economic incentives to support those activities, but we also believe that state and federal agencies have a responsibility to intervene with regulatory initiatives, if those measures fall short.

We appreciate the opportunity to contribute to this process and look forward to seeing the Director's final report.

Respectfully submitted.

Joe Logan, Director of Agricultural Programs
The Ohio Environmental Council

To: Interim Director Forshey, Ohio Department of Agriculture
Director Nally, Ohio Environmental Protection Agency
Director Zehringer, Ohio Department of Natural Resources

Via: Mike Bailey, Ohio Department of Agriculture
8995 East Main Street
Reynoldsburg, OH 43068

From: Karen Chapman, Regional Director, Environmental Defense Fund
(740) 363-8269
kchapman@edf.org
www.edf.org

Date: January 27,2012

Directors' Agricultural Nutrients and Water Quality Working Group

Environmental Defense Fund commends Governor Kasich and the Directors of the three state agencies: Ohio Department of Agriculture, Ohio Environmental Protection Agency, and Ohio Department of Natural Resources, for launching this very important initiative to find workable solutions to Ohio's severe water quality impairments. We participated in the DANWQWG meetings and served on the Production subcommittee. We also provided on-going comments to the Issues and Recommendations working draft and consulted with partners and internal members of our EDF ag and water quality team to generate the comments in this letter, and we thank the Directors for ensuring many opportunities for comment and dialogue throughout the process.

Environmental Defense Fund works with partners at the local, regional, state and federal level to find cooperative solutions to water quality problems caused by nutrients and sediments. We currently have significant efforts underway in the Chesapeake Bay, Upper Mississippi, and Western Lake Erie Basin watersheds. Our approach is to implement innovative adaptive nutrient management programs in agricultural fields, combined with targeting of wetlands and filters off the field, for optimum effectiveness in controlling and treating nitrogen and phosphorus nutrients.

Our recommendations will focus on two specific initiatives or "programs" that we believe encompass many of the issues and recommendations that emerged from the DANWQWG, and

that also: 1) could be implemented in watersheds as pilots across the state, 2) could potentially involve the majority of farmers in the most highly-productive areas of the state, 3) could provide a means of certification and accountability - for both the producers involved in the programs and for the agencies and organizations responsible for implementing the programs, 4) could be implemented quickly, at relatively low cost, for long-lasting results, and 5) combine research and implementation.

Program 1: Implement the 4Rs through Adaptive Management and the new NRCS 590 standard.

Assumptions:

- Producers need new tools to address water quality problems.
- Producers need to be equipped with better information in order to make decisions that are in their economic interest and in the interests of water quality.
- Producers can take more responsibility for decision-making when it comes to fertilizer applications.
- The fertilizer industry - including local co-ops and dealers - is positioned to move into a new type of service, one that includes helping farmers obtain, understand, and utilize information to greatly increase efficiency of fertilizer use, soil health and productivity, and economic outcomes.

The 4Rs - Right Place, Right Time, Right Source and Right Rate - for nutrients provides a good message and is a valuable source of education to producers about the need for better nutrient management. In order to put the 4Rs into action, producers need access to more and better information than they have ever had before regarding whether or not the maximum amount possible of what they apply to the field is actually being utilized by the crop. Some inefficiencies in fertilizer use and management will always exist because producers cannot control some external factors like weather. However, much more efficiency can be gained if producers and their trusted advisors are able to analyze information and use precision technology tools to learn from each season's crop and apply that knowledge to the next season. In some cases, the Right Rate for a given operation may even go well below current university recommendations.

Adaptive Management is a program administered by partners (generally, partners are a mix of the producers, advisors or CCAs, funding entities/mechanisms, data manager and analyzer, universities, SWCD techs, and NRCS representatives) and implemented within a region or watershed with willing producer participants. The tools analyzed include Pre side-dress N test, Fall aerial imagery, end of season cornstalk test, soil tests, strip trials for N and/or P or other products, GPS, yield monitors and management data. The farmers and advisors examine the data - including rainfall data - for each season in interactive winter meetings and use it to apply to decision-making for the next season. Each operation, field, crop, season, etc are different - so producers need to understand how all these variables are interacting in order to put the 4Rs into practice. Information is often what they lack.

The revised national NRCS 590 nutrient management standard allows for cost-sharing of Adaptive Management tools - including data analysis. A program to pilot the new 590 Adaptive Management program is currently being implemented in the WLEB. This effort was underway as the national 590 standard was being finalized. Even prior to the national 590 standard, EDF, NRCS, and independent CCAs launched the program in 2007 with a Conservation Innovation Grant. Then called the On-Farm Network®, the program is now called the Adapt Network for the Maumee, and a new program is recently underway: the Adapt Network for Grand Lake St. Mary's. The CCAs involved in these existing programs will be an integral part of the training, outreach and assistance needed to kick off the WLEB-wide initiative, as they already have four years of experience implementing the program. For producers currently enrolled in the Maumee program, an average of 30#/acre of nitrogen has been saved, on hundreds of thousands of acres. We are now developing a protocol for P strip trials that will help producers evaluate phosphorus applications and outcomes.

The program provides accountability because producers in the network work closely with their advisors to determine the Right Rate, Source, Time and Placement of nutrients, the data gathered is aggregated and made available to the public (individual farm data is kept private), and the CCAs administering the program are certified. The 590 standard provides further accountability for producers enrolled in the NRCS nutrient management program.

To go further with this program, it can be more broadly administered throughout a watershed by certifying those fertilizer retailers willing to implement Adaptive Management through the 590 standard, linking them to existing Adapt Network for the Maumee CCAs for training in strip trial protocol, CSNT and other tools, and working with NRCS, EDF, DNR, ODA, universities, producer groups, and other partners to ensure quality in program execution.

The program can expand beyond nutrient management (and has elsewhere) to encompass virtually any question for which producers desire an answer, e.g. research on cover crops and impact on yield, how well nitrogen inhibitors and stabilizers work, do fungicides improve crop production, how do different types of manure effect the crop, among many other considerations. It can also serve as a valuable forum for outreach to producers concerning their entire operation and provide a means of stimulating more thoughtful management in general.

Recommendation to Directors: Support implementing the 4Rs through Adaptive Management and promote Adaptive Management as the preferred method of determining the 4Rs for each operation. Work with the fertilizer industry and partners to help promote the program within the CCA community and implement the program in all major Ohio watersheds. Support training and certification of CCAs for implementation of Adaptive Management.
Cost: potentially very little, and would primarily consist of staff time, promotional materials, networking and organizing. Certification and administration costs would vary depending on the level of sophistication introduced. The program might also be funded through implementation of other suggestions in the Issues and Recommendations document, such as a fertilizer tonnage fee. For more information on active Adaptive Management networks, go to: www.agtechonfarm.net.

Program 2: Watershed-based Drainage Water and Ditch Management Initiative

Assumptions:

- Dissolved Phosphorus is entering waterways through a variety of means, including surface and subsurface flows.
- Practices need to be designed to address, as much as possible, the high flows associated with high nutrient loading events.
- Nutrient efficiency and agronomic BMPs alone will not solve the problem.
- The existing "footprint" of drainage ways and ditches can be better utilized and modified to treat nutrients leaving the field.

Much of the Dissolved Reactive Phosphorus leaving Ohio fields in the Lake Erie and Grand Lake St. Mary's watersheds is exiting through tile drainage. Kevin King's research (ARS) has shown that practically all of the Phosphorus that leaves the field through tile drainage is in dissolved form.[1] Research in Minnesota (Strock) has shown that drainage water management can reduce dissolved phosphorus by as much as 63%. King and others (Dr. Baker, Heidelberg) have discussed concern with soil stratification, wherein P is concentrated at the soil surface in residue and leaves the field through preferential surface and subsurface flow pathways during storm events.

Much discussion regarding soil stratification and phosphorus has centered around "incorporation." Our concern with centering the discussion around incorporation is chiefly that we will dial back significant gains made in erosion control and particulate phosphorus control by advocating for incorporation across the board, or advocating that any particular type of incorporation should be practiced on all acres. Incorporating phosphorus does not eliminate phosphorus from the soil profile and does not eliminate the risk of phosphorus exiting the field in dissolved form later. Increasing incorporation might actually increase the possibility that surface erosion can occur, carrying with it soil-bound phosphorus, which then becomes "available" in dissolved form, canceling out any benefits that might have been gained.

We also believe that solving our phosphorus problems long term will require a combination of in-field agronomic BMPs and off-field filters. These filters will need to be designed to limit the impact on agricultural land, particularly those areas of the state where taking much land out of production will not be viable. Throughout the corn belt and beyond, researchers have taken an interest in modifying agricultural ditches and streams in ways that can increase nutrient treatment, particularly to avoid taking more land out of production. Such modifications have been shown to increase nutrient processing and uptake, slow flows, increase flood storage, and provide farmers relief from flooded fields (e.g. see the Nature Conservancy of Indiana's work and research with Ohio State University and Notre Dame on 2-stage ditches).

The Ohio Department of Natural Resources' Division of Soil and Water Conservation would be ideally positioned to implement a pilot watershed drainage management program that would involve managing drainage water as it leaves the tile in subsurface flow (tile stops) and then treating the tile drainage water once it enters a stream by modifying existing drainage ditches to accommodate any number of features including more vegetation, a wider channel, a series of

[1] Stated during a presentation given at the ODA Bromfield conference room to the Ohio Chapter of the Soil and Water Conservation Society, 1/17/12

low dams (to control sediment), two-stage or over-wide channels, etc. The Soil and Water Conservation Districts in a given watershed would lead this effort, organizing willing producers in a given watershed to design a drainage water management plan, providing technicians to manage tile stops and train producers in managing tile stops, as well as providing follow up and accountability to ensure that drainage management plans are followed. Together with drainage water management, SWCD personnel could work with research partners and scientists to design ditch modifications where drainage management also exists, thus providing greater processing potential.

While it is unlikely that all producers in a given watershed would collaborate in such an initiative, innovative incentives for such collaboration that are based on performance and outcomes could be designed to maximize participation.

Recommendation to Directors: Establish a drainage water management initiative in a pilot watershed that potentially employs an innovative incentives mechanism based on performance and outcomes, and work with research and university partners to measure results.

January 27, 2012

To: Scott J. Nally, Director, Ohio EPA
James Zehringer, Director, ODNR
Dr. Tony Forshey, Interim Director, ODA

There are currently 530 practicing Certified Crop Advisers (CCA's) in Ohio working directly with farmers on a daily basis. The CCA Program's core values align with possible solutions to Ohio's water quality issues. The foundation of our program is continuing education, ethical practices, and implementation of best management practices (BMP's) that are beneficial to the environment and to the producer.

Our recommendations for education:

- More awareness of water quality problems need to be addressed to the ag industry and to farmers in specific watersheds. More individuals need to take ownership of implementing BMP's. CCA's could lead by example.
- We are required to maintain continuing education credits to remain certified. It would be seamless to incorporate watershed-specific education into our curriculum: we could then pass our knowledge on to our growers while maintaining our education requirements.
- Growers need to have access to the Revised P-Risk Index (through a website) in an easy-to-use- format so that it is widely available for producers, educators, and agencies. Currently, our NRCS state agronomist/CCA has been conducting such work.
- There needs to be more emphasis on CCA's writing Nutrient Management Plans, and also becoming Technical Service Providers. There is not possibly enough man-power to promote these programs as it currently stands, and CCA's could help implement them before they become required. Funding needs to be kept in place that rewards the farmers for putting these plans into place and that allow them to hire such individuals.
- We need to promote ways of getting fertilizer in contact with the soil under both conventional and no-tillage systems without promoting more tillage; or we will end up with reduced soil health and more erosion.

Our recommendations for research:

- CCA's are in a good position to help gather research data needed to fine-tune best management practices and have an excellent ability to communicate the message to our producers--once we have more answers—so growers can implement these practices.
- Edge of Field Studies need to be conducted so we narrow down the major causes of increase in SRP.
- We need to validate the parameters of the existing Phosphorous Risk Index and to quantify how different BMP's affect soluble phosphorous.
- BMP's need to be added to the revised P-Risk index so we have a better, more modern tool to give the producer more management options.
- More studies on cover crops should be done as to whether they can truly reduce SRP movement and to demonstrate whether an increase in microbial activity in the soil could make more efficient use of nutrients that are being applied. Cover crops have resulted in better soil health, including reductions in erosion and particulate phosphorous. Less phosphorous applications could possibly be needed as a result of more cover crop adaptation.
- Trials should be conducted to confirm the accuracy of the Tri-State Fertility Recommendations.

Certified Crop Advisers are trusted and respected by producers. Our goal is to implement BMP's before we are faced with heavy regulations.

- We need a workable time frame (perhaps 5 years) to implement the practices to see if they are working and actually reducing DRP's. If we haven't reduced nutrient loss in a respectable time frame by implementing new BMP's, then perhaps mandatory measures should be considered.
- More data needs to be collected on fertilizer product by county. A licensing program similar to that of the pesticide license could be implemented. Perhaps require 3 hours of nutrient management training in the first year, then add an additional category to their "Plant Health" applicator's license (it would include both pesticides & nutrients). Recertification would be a three year cycle for both private and commercial licenses.

Respectfully submitted on behalf of recommendations by the Certified Crop Adviser Board of Ohio,

Tina Lust
Chairman, Ohio CCA Board
5151 Reed Rd, Suite 126-C
Columbus, Ohio 43220 Office phone: 614-326-7520

OHIO CATTLEMEN'S ASSOCIATION

10600 US Highway 42 • Marysville, Ohio 43040
614.873.6736 • Fax: 614.873.6835 • Email: beef@ohiobeef.org
www.ohiocattle.org

Executive Committee

President
NCBA Director
Sam Sutherly
6700 E St Rt 41
Troy, Ohio 45373
937.335.3286
sam@sutherly.com

Vice President
Frank Phelps
8757 County Road 254
Belle Center, Ohio 43310
937.539.1442
frankph@watchtv.net

Treasurer
Jim Rogers
11153 Walnut Dowler Road
Logan, Ohio 43138
740.591.7311
jrogers@reedbaur.com

Member at Large
Stan Smith
10685 Busey Road
Canal Winchester, Ohio 43110
614.570.0593
smith.263@osu.edu

Past President
David Felumlee
11970 Cross Road
Newark, Ohio 43056
740.763.4616
dfelumlee@windstream.net

NCBA Director
Kris Vincent
9007 Hill Church Street
East Canton, Ohio 44730
330.323.1677
tripinefarm@yahoo.com

Executive Director
Elizabeth Harsh

January 27, 2012

The Honorable John Kasich
Governor
77 S. High Street, 30th Floor
Columbus, Ohio 43215-6117

Dear Governor Kasich:

The Ohio Cattlemen's Association (OCA) would like to express our appreciation for the opportunity to participate in the Directors' Agricultural Nutrients and Water Quality Working Group (DANWQWG). Protecting Ohio's natural resources, including the quality of our waters is of great importance to our association.

Ohio's history shows that the state's farmers have repeatedly demonstrated their commitment to doing what sound science has shown to be the right things to protect and improve the environment. And that commitment to environmental stewardship continues strong today.

Throughout the many meetings of the DANWQWG it is clear that we do not have all the information required to make sound decisions about dissolved reactive phosphorous, such as how it interacts with our water systems, how it might be leaving our farms, and what practices are the most effective in controlling any potential nutrient run-off. More research is critically needed and we applaud those that have the means to assist with funding this much needed research.

We do know that the way we farm today has changed significantly. And these changes have all been based on what's best for the environment, such as adoption of no-till practices and grid-sampling for more precise and reduced application of nutrients

Education is also an important part of this effort. We encourage the widespread adoption of best management practices that include following the 4 R's approach to nutrient application, utilization of soil testing and the adoption of nutrient management plans (NRP).

It is also important to note the tremendous variability with farming throughout the state depending on your location, soil types, topography, etc. As a result we must avoid a one size fits all recommendation.

We submit the following points for further consideration as solutions to these issues are discussed:

- All recommendations should be voluntary until additional research provides more information.

- Specific dates are not workable for when manure can or cannot be spread. Flexibility is required as weather conditions are constantly changing.
- Spreading of nutrients on frozen or snow-covered ground should be allowed when NRCS guidelines are followed.
- Weather is too unpredictable to tie regulations/recommendations to weather forecast windows.
- Do not recommend mandatory incorporation of nutrients as this conflicts with many conservation plans.
- More producer/farmer input is needed on committees making recommendations.
- Need differentiation between liquid manure, manure straw pack, and dry fertilizer and if fields being spread are cornstalks or bean stubble.

Once again, thank you for the opportunity to participate in the DANWQWG and provide these comments. OCA looks forward to continuing our involvement in the DANWQWG and the recommendations that the administration makes regarding this important issue.

Sincerely,

Samuel D. Sutherly

Sam Sutherly
President
Ohio Cattlemen's Association

Mike,
I hope and I am sure you will preface your report to Governor Kasich with the positives Ohio farmers have made to reduce the loss of soil phosphates. No question more can be done, but also consider the gains that have been made.

Unfortunately the majority of Ohio citizens have no concept of what it takes to get food to the grocery store shelf. Many will consider the phosphate issue a negative for Ohio farmers and will want to add more regulations to an already over-regulated industry.

I hope common sense prevails in any future decisions made in the handling of phosphates in the agriculture industry.

David Ashworth
Novozymes BioAg
419-889-1436

Date: January 24, 2012

To: Director Scott Nally
Director James Zehringer
Interim Director Dr. Tony Forshey

From: Ed Brown
Ag Nutrient Working Group Participant representing Crop Production Services

RE: Final Comments to be considered in your recommendations to Governor Kasich

Dear Directors,

First I want to express my gratitude for allowing and encouraging my participation in the Ag Nutrient Working Group forum. Thanks to your commitment and dedication to this process, I trust that we all have a better understanding of the water quality issues and challenges, that we face, relative to reasonable actions necessary, for solutions.

Second I want to express that Crop Production Services, is a national crop input and agricultural service company, with over 870 retail centers; 24 in Ohio. Crop Productions Services works very closely with the OABA, The Fertilizer Institute, and IPNI, with environmental issues impacting our industry; as well as, promotion of environmental stewardship, and sustainability. For consistency sake, CPS will support the industry positions and comments, of the OABA, TFI, and IPNI, relative to this process, in the State of Ohio. The comments in this memo, are specific to my personal involvement in the Working Group, and specific to my personal passion, commitment, and dedication to agriculture and our environment. Yes, I am employed by Crop Production Services; but I am a citizen first, in this great State of Ohio; and my views are simply that…my views.

Briefly, as final comments, for your consideration:

Please consider, in your recommendations to Governor Kasich:

- 4R Nutrient Management as the foundation for your recommendations. The 4R model is a dynamic one, that moves forward, with technology; and ultimately does and will positively impact the water quality issues in Ohio, relative to production agriculture, and nutrient management. The 4R model is specifically defined, agronomy science based, industry recognizable, and has an excellent track record, of producing positive environmental results.

- Education, Communication, and Outreach will need to be broad based relative to the target audience…including the agricultural landlords, or non-producing landowners. I would describe

or compare the Education, Communication, and Outreach necessary strategy, to be akin to the greatest undertaking of public relations strategy, ever witnessed in agriculture. Only when all citizens and stakeholders, truly understand "the problem", will "the solutions" be effective. Contrary to some of the Working Group discussion comments, farmers and industry are quick to adapt, when they grasp a firm understanding of issues and the associated potential solutions.

- Flexibility in your recommendations, relative to applications of nutrients (particularly phosphorus), to frozen ground. There are well intentioned, nutrient stewardship examples, that don't fit a hard and fast rule or regulation. For example, it is January, and we have encountered a 10 day period of complete soil thaw. Now we have a forecasted window of 5 days of surface soil freezing. The farmer wants his dealer to spread fertilizer, so that the farmer can follow the spreader with his chisel plow, while the ground is crusted/frozen on the surface. In this example, the intended practice is one of nutrient stewardship. Absolutely, we do not want to recommend leaving nutrients on the surface of frozen soil…but what is the definition of frozen soil? Do we want to discourage a sound nutrient stewardship practice, simply because it doesn't fit the rule? Please consider some flexibility and definition, here.

- Respectfully, please understand the dynamics of how rapidly, production technology is advancing farm production output, and the impact of these dynamics on the agricultural economy. In my 35 year industry career, I have never experienced how quickly crop yields are going up. I also have never experienced how quickly the farming economics have changed, relative to the cost of farming, and the farming revenues being appreciated in the agricultural markets. The global demand for food, the farm-gate impact of higher yields, and the socioeconomic impacts upon our State, will drive potential benefits…and more financial risk. I trust that in your responsibilities as Directors, and your accountability to the Governor and the State, you will weigh your extremely critical decisions, with foresight of thought, to allow for a balancing of risk and reward. I also trust, that we can be leaders, who think outside the box, and create strategies that will allow for ongoing production growth, without adding to the producer's financial risk…and positively improve our water quality and environment.

Thank you, again for allowing the opportunity to comment. I value your leadership and direction; and I very much appreciate your efforts and energy, with the task at hand. Best of luck and support of you, and your efforts, with this complex and important endeavor.

Respectfully,

Ed Brown
Crop Production Services
Ag Nutrient and Water Quality Working Group
603 West 1st. Street
Arcanum, OH 45304
937-564-6174
ed.brown@cpsagu.com

Commissioners Office

HARDIN COUNTY COMMISSIONERS
ONE COURTHOUSE SQUARE, SUITE 100
KENTON, OHIO 43326
419-674-2205
FAX 419-674-2272
E-Mail: hccom@co.hardin.oh.us

BRICE S. BEAMAN
EDWARD O. ELLIOTT II
RONALD D. WYSS

January 26, 2012

Director Scott Nally
Director James Zehringer
Director Tony Froshey
c/o Michael Bailey

RE: NUTRIENT WORK GROUP COMMENTS

Dear Directors:

Thank you for organizing the Nutrient Work Group to address the ag runoff issues in Ohio. And, I thank you for allowing me to participate.

It is important that you adopt the 40-50 PPM limit on phosphorus soil tests. The most recent chart developed by Ohio State University clearly shows that even high production agriculture is not negatively affected by the 40 PPM maximum limit. Any application that exceeds that limit will contribute to excess phosphorous runoff and subsurface leaching and therefore must be considered waste disposal.

The use of the NRCS 590 and 633 standards allow much higher rates of application and the P-risk index allows even more. Ohio regulations should require the 40-50 PPM limit when using the NRCS 590 and 633 standards. The P-risk index should not be used under any circumstances.

The only way to initiate this system is to require a GIS based soil test on every unit of land in the state before phosphorous may be applied. This data could easily be downloaded to a central server. The data could be encrypted and password protected to satisfy privacy concerns.

This approach is a win/win solution. It will allow maximum agronomic production and reduce phosphorous loading to our water.

Sincerely,

Ronald D Wyss

Ronald D. Wyss

BLUE STONE
SOLUTIONS Ltd.

2756 Redwood Drive
Springfield, Ohio 45504-3920
(937) 605-6380
www.bluestoneag.com

The quality of water is as critically important as being able to produce food for the world's increasing population. Ohio and the United States have a huge responsibility to continue to feed the people of the world, but we also have a responsibility to do so in an efficient and low impact manner. Technology and science are finally giving us the ability to do both.

In the past couple of years, farmers have started to use liquid fertilizer products that can be incorporated into the soil at planting time and completely replace a traditional nutrient program. These programs place only as much nutrients as the plant needs to grow where the plant can easily access them, eliminating much of the problems of over-fertilization. Farmers using these programs, under the almost impossible conditions of the spring of 2011, were able to fertilize and plant their crops in an incredible four days. All farmers have planting systems that can be retrofitted to incorporate into the soil as they plant and this type of program can be applied to all sized farming operations.

These liquid fertilizer products are manufactured here in the United States, sold across the United States as well as internationally and apply to a diversity of crops. Traditional agribusinesses are structured for dry fertilizer that is broadcast on frozen ground in order to spread out labor and cash flow in a very seasonal business structure. Advancements in technology have provided alternatives and will continue to advance the abilities of farmers to reduce their impact on the environment. Using these alternative programs would reduce the nutrient placement concerns of current practices. We believe that farmer education on retrofitting planting equipment for nutrient incorporation will positively impact the current nutrient placement problems facing our watersheds, without causing us to lose our progress with no-till and soil erosion. At the very least, changing to dry fertilizer placement through the planter would address some of the concerns of fertilizer placement.

Big problems generate big ideas implemented by innovative leaders. Farmers are good and independent people. If you ask, they will do it.

Thank you for your attention,

Ed Cross, CCA
Diane Cross
Brenna Cross
Charlie Troxell

The Andersons Inc.
P.O. Box 119 • Maumee, Ohio 43537 • 419/893/5050

January 27, 2012

Directors' Agricultural Nutrients and Water Quality Working Group
c/o Mike Bailey, ODA

Sent via electronic mail

Dear Sirs:

The Andersons is pleased to offer the following comments to the Directors of ODA, ODNR, and OEPA in anticipation of their formal recommendations to Governor Kasich on the Lake Erie phosphorus issue.

The Andersons has been an active participant in the meetings from the genesis of the Directors' Agricultural Nutrients and Water Quality Working Group, believes that the ag industry has to play an active role in the process, and is proud to serve as one of the industry representatives to the directors' working group.

The Andersons is a strong advocate of the "4R" program promoted by The Fertilizer Institute (TFI) and the International Plant Nutrition Institute (IPNI), and others and has been promoting this among our customers in Ohio as well as the other states where we have fertilizer operations. The "4R" nutrient stewardship program speaks directly to what we are all about. The Andersons fully subscribes to the principles of "4R" – Right Source, Right Rate, Right Time and Right Place. As members of the agricultural community, we believe it is our responsibility to continuously improve and grow with the latest in technology and proven science. We believe efficient food production and the protection of the environment are not mutually exclusive goals. Because 40 to 60 percent of the world's food production is made possible through the efficient use of fertilizers, this natural resource and the industry that provides it must be at the center of the discussion.

The Andersons, like others in the ag industry, employs Certified Crop Advisors (CCAs) whose primary mission is to interface directly with the farmer / producer to assist them in making sound decisions on how best to manage their crops and improve their crop production practices. In this capacity, the CCA has significant influence on fertilizer purchasing and application practices. In particular, our CCAs take advantage of every opportunity to educate their customers on maximizing the impacts of the producer's fertilizer expenditures. This is accomplished through the use of the "4R" educational materials as well as other resources.

In addition, The Andersons utilizes a number of other educational forums to try to reach the producer so that they have the opportunity to be exposed to this issue. For example, The Andersons will co-sponsor along with the Ohio Agri-Business Association the Lake Erie Watershed Crop Nutrient Retailers Meeting on February 29, 2012 for the specific purpose of educating ag retailers who in turn will communicate with area farmers.

The Andersons is a strong advocate of the communication and promotion of "best practices". In that regard, we have been advising ODA through the working group's activities of the kind of efforts that have been made in the other states where we do business that might be of benefit in Ohio. Examples include Indiana's new training and licensing rules and Florida's new process for collecting tonnage data, both of which are viewed as significant issues for Ohio.

The Andersons believes American agriculture continues to enhance agricultural output, improves soils for future generations, and strives to make each tomorrow better than today. The abundance provided by American agriculture creates the foundation for which all families and communities have the opportunity to prosper and thrive. Our corporate Statement of Principles affirms our commitment to sustainability – "As responsible members of our community, we should take appropriate steps to safeguard the health and safety of our employees, customers and neighbors and to protect the quality of the environment in which we work and live."

Furthermore, The Andersons believes that the ag industry has to be part of the solution. Without the industry's involvement, we are not likely to be successful.

Lake Erie is an invaluable resource. We applaud the directors for pulling this working group together and creating the opportunity for so many academics, regulators, producers, industry representatives, and others with a vested interest to come together to work to solve this important issue for our state.

Sincerely,

Stacy Schmidt, MPH, MS
Director, Corporate Hazard Management

MORRAL
COMPANIES, L.L.C.

January 27, 2012

Mike Bailey
Ohio Department of Agriculture
8995 E. Main Street
Reynoldsburg, OH 43618

Mike,

This letter is intended to affirm Morral Companies' support for the Director's Agricultural Nutrients and Water Quality Working Group and its report to the Governor. Concern for the environment and, specifically, the quality of Ohio's air and water has always commanded a high priority within our company. We recognize the critical role agriculture plays in our state's economic well-being and the responsibilities that we must bear as good citizens and stewards of our precious natural resources.

As long-time members of The Fertilizer Institute (TFI), the Agricultural Retailers Association (ARA) and the Ohio Agribusiness Association (OABA), to name a few, we have been quick to embrace and support air and water quality initiatives, with particular emphasis on the 4R Nutrient Stewardship program authored by TFI and the International Plant Nutrient Institute (IPNI). As a strong early adopter of the 4R program, we have conducted various meetings and training sessions with our employees, our growers, custom applicators and others. We have actively participated in other working groups which focus upon specific watershed issues in our local trade area. And we will continue with these efforts.

Most recently, one of our customers, Loyer Farms, in Caledonia, Ohio has been selected by TFI as one of five growers picked from 36 nominees from all over North America as a farm enterprise that most effectively represents the 4R initiative in action. We were proud to recommend them for this honor and elated that they were chosen. Grower acceptance of air and water quality initiatives is absolutely vital to any success we are to achieve. Likewise, buy-in and support from the State's Certified Crop Advisors (CCAs), is of paramount importance, as they are the ones making on-farm recommendations and they are trusted and respected by their growers. So, too, are our custom operators, who actually apply the Right nutrients at the Right time, in the Right place and at the Right amount. And finally, our field sales personnel, five of whom are CCAs, have been directed to use 4R as an outreach tool to their customers and to work to raise the awareness level for this fine program.

We'd like to close by congratulating you, Mike, and your able colleagues at ODA for all of your hard work and efforts to make the Working Group a success. Kudos must also be extended to Tina Lust as Chairman of Ohio's Certified Group Advisors Association for her splendid help and support. And finally, please extend our best wishes to Directors Zehringer, Nally and Forshey as they work to finalize our group's recommendations to the Governor. And we would be remiss if we did not also acknowledge our appreciation to Governor Kasich for his leadership on these issues. Here at Morral, we stand ready to assist all of you in these efforts. Agriculture is the backbone of Ohio's economy and future success will be assured if we all work together to make this initiative a success.

Sincerely,

Daryl R. Gates

Daryl R. Gates
President & CEO

132 Postle Street • P.O. Box 26, Morral, Ohio 43337

740-465-3251 800-554-3981 FAX: 740-465-9781

OHIO DAIRY PRODUCERS ASSOCIATION

Supporting Ohio's dairy production industry; optimizing profitability and productivity; addressing issues that affect dairy producers

January 27, 2012

Michael D. Bailey, Executive Director
Office of Farmland Preservation & Ohio
Livestock Care Standards Board
Ohio Department of Agriculture
8995 E. Main Street
Reynoldsburg, OH 43068

RE: Recommendations for the Directors' Agricultural Nutrients and Water Quality Working Group

Dear Mr. Bailey,

First, let me express our appreciation for the opportunity that the Directors have provided the agricultural industry to engage in an open and transparent discussion regarding the issue of increased levels of dissolved reactive phosphorus in the states waterways and lakes.

While the entire source of the problem is not readily identifiable, Ohio's dairy farmers acknowledge the seriousness of Ohio's surface water quality problems and realize that agricultural nutrients are a contributing factor. ODPA is committed to being a part of the solution to reduce the agricultural nutrient transport into Ohio surface waters and will continue to participate in the ongoing research, education and identification of improved best management practices that will help Ohio reach the goal of improved water quality while maintaining our ability to apply effective rates of nutrients that sustain highly productive grain and forage yields.

While there are several issues and recommendations that have been identified, ODPA would like to highlight the following input as the Directors formulate their final report to the Governor.

ODPA offers the following observations and input:

- ODPA supports an enhanced education and communications effort for farmers, fertilizer dealers, and applicators
  - The ongoing research and findings will serve as an important factor in equipping farmers with the right information that they can use in selecting best management practices
- ODPA supports an enhanced education regarding the 4 Rs
  - Right Time
  - Right Place
  - Right Source/Material
  - Right Amount

Continued on back of page

5950 Sharon Woods Blvd • Columbus OH 43229 • Office 614 890 1800 • Fax 614 890 1636 • www.odpa.org

- If the education and communications effort is <u>not</u> effective, then ODPA is open to considering a certification program of fertilizer applicants
  - commercial fertilizer certification must be kept separate from manure nutrient certification
- ODPA supports voluntary soil test data collection by county (privacy of farm must be protected)
- ODPA supports soil testing every 3 years
- ODPA supports harvesting buffer strips
- ODPA supports voluntary fertilizer application tonnage data collection by farmers (privacy of farm must be protected)
- ODPA supports additional edge-of-field research to determine actual nutrient value transport
- OSU's data for manure nutrient values must be updated and provided to livestock farmers
- ODPA <u>does</u> <u>not</u> support date limitations on manure nutrient applications
  - We must allow reasonable amounts of manure applications when the soil conditions are right, regardless of the date
  - Smaller tonnage rates/acre applied more frequently is better than one large spring application
  - Weather / precipitation conditions must be considered prior to application
- ODPA agrees that fall fertilizer application and tillage must be managed to reduce nutrient runoff
- ODPA supports the development of an online Nutrient Management Planning tool
  - This online planning tool/calculator must be linked to the online P Risk Index web based data system for most effective usage
  - This online tool would assist farmers with their voluntary Nutrient Management Plans and assist farmers in managing toward meeting their CNMPs

If the need should arise and it is collectively determined that fertilizer regulation is required, then ODPA would support the Ohio Department of Agriculture serving as the state agency to oversee those regulations.

In conclusion, ODPA offers our continued support and ongoing participation with the Directors of ODA, OEPA and ODNR in pursuit of identifying the sources of the dissolved reactive phosphorous and other nutrients affecting the State's waters and we will participate in assisting the agricultural community in doing its part to be a part of the solution.

Respectfully submitted,

Scott E. Higgins

Scott E. Higgins
C.E.O.

OHIO NURSERY & LANDSCAPE ASSOCIATION

Enhancing the environment and quality of life for all

Director Forshey
Ohio Department of Agriculture
8995 East Main Street
Reynoldsburg, Ohio 43068

Director Nally
Ohio Environmental Protection Agency
50 West Town Street, Suite 700
Columbus, Ohio 43215

Director Zehringer
Ohio Department of Natural Resources
2045 Morse Road, Building G
Columbus, Ohio 43229

Dear Directors Forshey, Nally and Zehringer,

This letter is written to supplement the recommendations being developed by the Director's Agricultural Nutrient Water Quality Work Group (DANWQWG) on behalf of the Ohio Nursery and Landscape Association (ONLA).

As nursery growers and landscapers in the state of Ohio, please know that we are very concerned about the environment and our resources.

As you prepare to make recommendations relative to protecting water quality in the state, please know that phosphorus is an essential element in the production of nursery stock and the maintenance of turf. Without maintaining the proper levels of phosphorus available to the plant, the entire metabolical process is affected. When this happens the plant "shuts down" thus causing other elements not to be taken up and leached out of the soil.

As this process of developing recommendations to the Governor moves forward, we need to be sure that sound science is used to make decisions on both proper timing and rates of application to ensure quality plant and turf growth. As a potential stake holder in this decision, the ONLA would ultimately like to have the opportunity to work with researchers that can establish proper BMP's for our members.

The Ohio Nursery & Landscape Association, Inc.
72 Dorchester Square / Westerville, OH 43081-7300
p. 614.899.1195 / 800.825.5062 f. 614.899.9489
www.onla.org / info@onla.org

OHIO NURSERY & LANDSCAPE ASSOCIATION

Enhancing the environment and quality of life for all

The nursery and landscape industry is a vital and growing part of Ohio agriculture contributing approximately $4.2 billion to the Ohio economy. We have a rich history of family farming in the state and are proud of the national reputation for excellence we have earned based upon not only our agricultural practices but also the governance of our industry lead by the Ohio Department of Agriculture. We look forward to continuing to work with you on this issue and others in the weeks and years to come.

Sincerely,

Andrew C Harding

Andrew C. Harding, President , Ohio Nursery and landscape Association.

Office 440-259-2725
Cell 440-552-8251

The Ohio Nursery & Landscape Association, Inc.
72 Dorchester Square / Westerville, OH 43081-7300
p. 614.899.1195 / 800.825.5062 f. 614.899.9489
www.onla.org / info@onla.org

OPARR

Your Resource for Pesticide Information

Ohio Professional Applicators for Responsible Regulation

Director Forshey
Ohio Department of Agriculture
8995 East Main Street
Reynoldsburg, Ohio 43068

Director Nally
Ohio Environmental Protection Agency
50 West Town Street, Suite 700
Columbus, Ohio 43215

Director Zehringer
Ohio Department of Natural Resources
2045 Morse Road, Building G
Columbus, Ohio 43229

Dear Directors Forshey, Nally and Zehringer,

On behalf of the Ohio Professional Applicators for Responsible Regulation "OPARR", thank you for your exemplary leadership throughout the meetings of the Director's Agriculture Nutrient Water Quality Workgroup "DANWQWG". We want to commend you and your wonderful staff for marshaling a large group of stakeholders through a complicated but important subject. We realize that the recommendations being proffered to Governor Kasich are but a first step of many toward realizing improved water quality in Ohio.

Before delving into some general comments on the proposed recommendations, an introduction to OPARR is in order. OPARR is an alliance of associations, businesses, and individuals from lawn care, pest management, golf course, tree service, grounds management, landscaping, parks and recreation, and related industries. OPARR members are manufacturers, distributors, and applicators of pest management, fertilizer, weed control, and related environmental products who are dedicated to the responsible use of these materials in communities throughout Ohio. The materials used by OPARR members have resulting in healthier and more pleasant and productive lives and the protection and conservation of our environmental resources. OPARR is committed to working in cooperation with federal, state, and local government officials, and other environmentally-concerned organizations to ensure effective use of agricultural, turfgrass and tree care products in an environmentally sound manner. Among our association members is the Ohio Farm Bureau Federation (OFBF). We understand that OFBF has submitted comments of their own. So, while OPARR represents a broad spectrum of companies and organizations affiliated with agriculture, this letter is limited to turfgrass.

OPARR believes that the recommendations discussed at the January 23 meeting broadly cover a number of important aspects to consider in affecting positive changes in water quality including research, education, communication, incentives and possible regulatory modifications in the future. While certainly the vast majority of the recommendations pertain to traditional agriculture, there are a few instances where the subject of turfgrass (e.g. Sod production, recreation/athletic fields, golf courses, and home lawns, etc...) was

referenced. As such, we thought it prudent to provide some general comments on the benefits of healthy turfgrass as it pertains to phosphorus.

Consistent with research across the country, the Ohio Lake Erie Phosphorus Task Force considers phosphorus contributions to increasing algae blooms from lawn care fertilizers to be low. Lawns are an important asset and help mitigate the impacts of impervious surfaces in our residential areas; reducing the flow of nutrient and sediment into our surface waters and protecting these important resources. University research demonstrates that properly fertilized lawns generate less nutrient flow and reduced run-off volumes that unfertilized lawns. Lawns provide critical environmental services in our urban communities where they capture and filter rainfall, prevent soil erosion, and reduce storm water volumes impacting our local waterways.

In summary, as stated above, well managed/maintained turfgrass is an essential tool in filtering and retaining rainfall while preventing soil erosion and utilizing phosphorus. That being said, it is noteworthy that significant research has been conducted and implemented in the turf industry resulting in reductions in phosphorus in maintenance of turf in consumer products and commercial applications. We are proud of the strides we have taken to date and we look forward to sharing our best practices with you during this process.

We hope that you will allow OPARR to serve as a resource for you as Ohio continues down the important path of improving our water quality. Again, thank you for your coordinated, substantive, timely and efficient response to the state's water quality needs. While some states are tempted to take emotional, knee-jerk reactions, without question, your work has exemplified the "common sense" approach Ohio needs.

Respectfully,

Belinda Jones

THE OHIO STATE UNIVERSITY

Department of Food, Agricultural, and Biological Engineering

Agricultural Engineering Building
590 Woody Hayes Drive
Columbus, OH 43210

Phone (614) 292-9354
Fax (614) 292-9448
E-mail ward.2@osu.edu

Michael D. Bailey, Executive
Director Office of Farmland
Preservation & Ohio Livestock Care
Standards Board Ohio Department
of Agriculture
8995 E. Main Street
Reynoldsburg, Ohio 43068-3399

January 26, 2012

Dear Mr. Bailey:

Thank you for the opportunity to help address problems associated with nutrient and sediment loadings to Ohio's surface water resources. We applaud ODA, ODNR and OEPA for the open and inclusive process that has been used to consider diverse viewpoints from stakeholders with a vested interest in the impacts of the problem and approaches that might be used to solve these problems. We appreciate inclusion of the scientific community, which has aided stakeholders in identifying the causes of the problems and helped to outline a suite of practices, technologies and educational activities that might be used to develop viable, equitable, and cost-effective solutions.

In our attached comments and recommendations we have identified ten important underlying factors to solving Ohio's nutrient and sediment issues. In particular, we feel that: (1) all solutions should be based on system-specific knowledge and consideration of the causes and pathways of water, sediment and nutrient movement from fields through drainage networks and into lakes; (2) a process-based systems approach should be used; (3) the focus should not be solely on soluble reactive phosphorus, but on all nutrients and sediment; (4) in some cases, a combination of approaches will be needed to provide year round reductions across a range of precipitation events; (5) farming practices that are field specific are likely to be the most practical, beneficial and affordable but might not always provide adequate reductions in flow, nutrient, and sediment exports; (6) decades of experience in other locations indicate that edge-of-field and in-stream treatment practices will be needed in some settings; and (7) new outreach education and research activities will be needed to provide both short-term and long-term solutions.

As a primary approach, we need to improve the efficiency of fertilizer use, reduce the magnitude of water discharges, and reduce the adverse water quality signature from agricultural fields. The most effective strategies will be approaches that reduce the amount of fertilizer needed, incorporate fertilizers without increasing runoff and sedimentation, reduce the time fertilizers are in fields, and maintain growing crops in fields.

Faculty and staff in our department and college have the knowledge to assist in developing solutions to these problems, providing leadership to establishing the needed outreach education program and conducting some of the inter-disciplinary and multi-organizational research that still is needed to develop long-term sustainable solutions. Please do not hesitate to contact use if you have any questions or if we can be of further assistance.

Andy Ward and Jonathan Witter

Cc: Scott Shearer, Bobby Moser, Steve Slack, Keith Smith

Department of Food, Agricultural, and Biological Engineering

Agricultural Engineering Building
590 Woody Hayes Drive
Columbus, OH 43210

Phone (614) 292-9354
Fax (614) 292-9448
E-mail ward.2@osu.edu

Comments and recommendations on approaches to prevent problems associated with nutrient and sediment exports to the surface water resources of Ohio

Andy Ward, Jon Witter, Larry Brown, Scott Shearer
Food, Agricultural and Biological Engineering Department
The Ohio State University
January 26, 2012

Overview

In Ohio, industries associated with agriculture employ about one million people. It is our largest industry with an annual input of more than $90 billion dollars to our economy. With an ever expanding world population the need for high quality, affordable food will continue to increase. However, coupled with this is the need to protect and carefully manage our water resources. The Great Lakes contain one-fifth of the world's fresh water and about 90% of the fresh water in the United States! More than 40% of Ohio's population live in the Lake Erie Basin and it supports a diversity of human activities and biological life. The Western Lake Erie Basin Water Resources Protection Plan reports that the Western Basin provides more than 400 million gallons of water a day to water treatment plants and annual non-agricultural inputs from tourism, seaports and sport fishing are ~$9 billion dollars. For this situation, in our opinion there is little value in attempting to weigh crop production benefits and impacts versus water resource benefits and impacts. Each are of vital importance to individual stakeholders impacted by these issues, the State of Ohio, the Nation, Canada, and globally. There is no simple or quick solution and recovery from adverse ecological impacts is likely to be difficult and may take many decades.

Although there are several point and non-point sources of nutrients and sediment that impact our surface water resources our comments and recommendations focus on agricultural crop production systems in part because they are a major contributor and also because these systems are a main focus of our research and outreach activities. While extremely important, we have not addressed disposal of manure as to a large extent these practices are regulated. Also, while we have focused on Lake Erie we feel that attention is needed for all surface water systems in the State. Underlying factors in developing our recommendations are: (1) all solutions should be based on system specific knowledge and consideration of the causes and pathways of water, sediment and nutrients movement within fields, from fields, through lotic systems such as ditches and streams, and into lakes; (2) a process based systems approach should be used; (3) the focus should not just be on one constituent such as soluble

reactive phosphorus (SRP); (4) in some cases a combination of approaches will be needed to provide year round reductions across a range of precipitation events; (5) farming practices that are field specific are likely to be the most practical, beneficial and affordable but might not always provide adequate reductions in flow, nutrient, and sediment exports; (6) decades of experience in locations, such as the Chesapeake Bay, indicate that edge-of-field and in-stream treatment practices will be needed in some settings; (7) new outreach education and research activities will be needed to provide both short and long term solutions; (8) historically, voluntary approaches that provide incentives to adopt BMPs have been the most successful; (9) new sources of funding will be needed to supported the needed incentives, research and outreach activities - these initiatives might include the establishment of an Ohio Water Resources Program/Institute at OSU and new funding sources might include a fertilizer check off fee, state funds to provide needed matches for Federal competitive grant program, and funding from other sources; and (10) we (the State of Ohio) should use as building blocks the findings of the Directors' Agricultural Nutrients and Water Quality Working Group, other initiatives such as the Ohio Lake Erie Phosphorus Task Force, and the numerous scientific studies, fact sheets, manuals, demonstration projects, and solutions that are reported in a variety of readily retrievable outlets.

A fundamental approach to addressing any environmental issue is to identify the cause and then identify effective, viable, and cost effective treatment measures. The solution often becomes more costly as we move further away from the source. Therefore, as a primary approach we need to improve the efficiency of fertilizer use, reduce the magnitude of water discharges, and reduce the adverse water quality signature from agricultural fields. The most effective strategies will be approaches that reduce the amount of fertilizer needed, incorporate fertilizers without increasing runoff and sedimentation, reduce the time fertilizers are in fields, and for much of each year have growing crops in our fields to provide cover. In Tables A and B at the end of our comments and recommendations we have summarized the results of a few scientific studies to illustrate the potential for different approaches to remove SRP. We have initiated an extensive review of the literature and can provide citations to support much of what we have included in this document.

Causes of the Problem in Lake Erie

In their Final Report the Ohio Lake Erie Phosphorus Task Force states that *"The majority of annual phosphorus loading to Lake Erie has been documented to be from the storm-pulsed runoff from the landscape into the tributaries that drain to Lake Erie. The connection to weather events makes these loads highly variable from week to week and year to year."* Incorporated in their Final Report is an excellent analysis that was performed by Heidelberg University. To better understand the issue we conducted a small study of our own that we have included as Appendix A to this document. We concluded from our study that: (1) reducing SRP concentrations to 0.01-0.02 mg/l will require application of several BMPs to provide year round reductions; (2) no single approach is likely to reduce concentrations below 0.02 mg/l ; (3) the annual number of large rainfall and discharge events is increasing; (4) SRP concentrations are increasing; (5) the majority of the time SRP loads exceed 0.03 mg/l and annual mean SRP loads are approaching or exceeding 0.1 mg/l in creeks and large rivers; (6) large SRP loads are a year round problem: (7) a large majority of the SRP loads occur when discharges

are greater than 10% of the 2 year recurrence interval discharge – these discharges approximate bankfull discharges ; (8) less than 12% of the SRP loads occur when discharges are greater than the 2 year recurrence interval discharge; (9) peak loads during large discharge events often exceed 0.2 mg/l and depend on the time of year and time of farming practices such as tillage and fertilizer applications; and, (10) a substantial part (not necessarily the majority) of the discharge is subsurface drainage.

Many theories and ideas have been presented on why SRP concentrations have increased during the past decade. We agree with the thoughts presented in the Ohio Lake Erie Phosphorus Task Force report and additional thoughts provided by the NRCS (http://www.oh.nrcs.usda.gov/technical/drp_wleb.html) who state:

> *"There is no doubt that the increase in soluble phosphorus is real, but there are many factors, and probably a combination of factors, that could be driving it. These include:*
>
> - *Changes in methods of fertilizer application from banding through planters to broadcast surface applications, and from spring to fall or winter applications. These methods have become more popular as equipment has gotten larger, and each farmer is farming more acres, and trying to minimize time and labor requirements.*
> - *The trend towards applying two years of fertilizer in one year on the corn crop. This provides a cost savings in application labor and time needed to do application without suffering any agronomic yield reductions, which is an advantage to the applicator and the farmer. At the same time, it puts more material, at higher rates, out on the landscape longer.*
> - *More application in the winter months as custom applicators try to maximize efficiency and keep equipment and staff busy. Also, transportation issues, storage limitations, and pricing structures may influence the market to encourage fall or winter applications.*
> - *A gradual long term increase in soil phosphorus levels within the basin over a thirty-forty year period as farmers have attempted to maximize crop yields.*
> - *Larger equipment and the farming of more acres may be causing more soil compaction in the basin, decreasing infiltration, and increasing surface runoff in major storm events.*
>
> *Steve Davis, Watershed Specialist with NRCS, believes that the increased use of conservation tillage systems could be one of the several contributing factors by increasing to some degree phosphorus stratification in the soil surface. However, he believes that the cause is more likely "all of the above." And, given the critical need to control sediment delivery to the basins streams, drainage ditches, and to Toledo Harbor, going backwards on no-tillage is not the answer. "We can't trade one new problem to go back to another old one that we had before," Davis maintains.*
>
> *If anything, Davis says the uncertainty points out the need for substantial new and additional research needed by our Universities, our Land Grant Institutions and our Agricultural Research Institutions into the exact forces driving the changes in runoff and the Best Conservation Management Practices that will mitigate the problem."*

Of particular importance is the statement that "*going backwards on no-tillage is not the answer*." We address this in the next sections.

In-Field Pathways and Practices

In most of our agricultural fields the soil zone of interest has a depth of less than 6 ft. In our watersheds that drain to Lake Erie more than 60% of our fields have subsurface drainage systems that are located 3-4 ft below the ground surface. These systems are a key component of our farming systems. They are able to remove a portion of the water that can be drained due to gravity flow. For example, a 40 inch deep zone with a porosity of 40% will contain 16 inches of water when saturated. About 3-5 inches of this water will be the water content above field capacity (water that can be drained by gravity) and subsurface drains might drain 0.5-2 inches of this water. Subsurface drainage systems can only drain water that reaches them through gravity flow. The pathways to subsurface drains are flow through the soil matrix, macropore flow, and surface runoff that reaches the subsurface system through surface inlets. Runoff might occur whenever the rainfall rate is higher than the infiltration rate. Surface runoff and macropore flow will usually have much higher SRP and sediment loads than subsurface drainage of water that has moved through the soil matrix. In contrast, the highest nitrate loads will be from subsurface drainage of water that has moved through the soil matrix. Surface runoff can leave the field by entering subsurface drains, discharging through grassed waterways, discharging through a grass buffer or discharging directly into a ditch. Grassed waterways and grass buffers remove sediment and particulate phosphorus. Injection, banding or incorporation of fertilizers and in particular phosphorus will greatly reduce nutrient discharges in runoff. In some cases fields with subsurface drainage might have greater water discharges than fields without subsurface drainage but generally this is not the case. Therefore, from a process viewpoint BMPs should: (1) use a farming system, such as reduced tillage that retains residue in the system, that reduces macropore flow, increases infiltration through the soil matrix, and increases the porosity of the system; (2) reduces surface runoff and directs discharge through grassed waterways and grassed buffers; and (3) controls subsurface drainage during non-production periods to reduce exports of nitrate nitrogen.

The Farming System

Appropriately, in the deliberations of the *Directors' Agricultural Nutrients and Water Quality Working Group (DANWQWG)* much attention was placed on the farming system and in particular approaches to increasing the efficiency of fertilizer use, methods to incorporate fertilizers in a reduced tillage system, the use of cover crops, and approaches such as soil testing that aid in identifying fertilizer needs. In addition, there was discussion on recording fertilizer use and developing field or farm specific nutrient management plans. These are all sound concepts and a major need that was identified is the development of outreach education materials, tools, and activities to aid the producer in establishing effective practices that optimize a combination of resources, economics and environmental benefits. Coupled with this will be a need for incentives to increase adoption and offset costs. There is a need for further research relating to the farming systems as knowledge is limited on the best site specific combination of practices to reduce nutrient and sediment exports to target levels. In addition, we feel that practices such as precision farming, intercropping, and more use of cover crops can play an important role in providing long term sustainable solutions.

The Role of Subsurface Drainage

Part of the reason for the high agricultural productivity of the Lake Erie Basin is due to subsurface drainage. Typical yield increases due to subsurface drainage are more than 30% for corn and soybeans. In addition drainage plays an important role in the establishment of soil water conditions that facilitate trafficability for production activities such as planting and harvesting. One suggestion has been to have a moratorium on subsurface drainage. Even if this was a viable approach there is no evidence to suggest that this would result in lower discharges of SRP to Lake Erie. In fact, we estimate that if subsurface drainage was increased from 70-80% to 100% of the area currently under crop production in the Lake Erie Basin there would be a 10-20% reduction in SRP discharges associated with these crop production systems. There is no practical approach to preventing all drainage from existing subsurface systems and it is questionable what the benefits might be of stopping the installation of new subsurface drainage systems. The adoption of controlled drainage would be viable on many fields with slopes less than one percent. However, the main benefit of this approach would be average reductions of 30-40% in the nitrate nitrogen exports. There is a cost associated with the approach and in a minority of cases benefits might be small. In addition to controlled drainage, subsurface drainage systems do in many cases provide a point discharge where a treatment approach could be used. Use of treatment practices for SRP has to a large extent been restricted to research studies and demonstration projects. There is evidence to suggest that use of gypsum, alum, iron based industrial byproducts and water treatment residuals can result in 40-60% reductions in SRP exports.

We agree with the Ohio Lake Erie Phosphorus Task Force recommendation that "complementary practices (such as tile drainage control structures and management, and other hydraulic/treatment *buffers) be promoted to facilitate more widespread adoption of BMPs that ameliorate water quality impairments attributable to subsurface drainage. The Task Force also recommends that all surface drainage systems be evaluated to determine which complementary BMPs can best ameliorate the water quality issues caused by pollutants carried by surface drainage systems. Lastly, the Task Force recommends that more extensive research be conducted on sampling discharges from tile drain systems, incorporating data on the land management variables that contribute to the quality of tile drain discharges."*

Ditch and Wetland Treatment Approaches

There is a large body of literature on the water quality benefits of wetlands, but the role that processes in ditches have on the export of sediment and nutrients is unclear and highly variable results have been reported in the scientific literature. In some cases these systems can act as both sinks and sources of sediment and nutrients, but in the large majority of cases they aid in cleansing our surface water resources. In a recent publication by Dave Baker, Pete Richards, Andrew Sharpley and scientists in England (*Quantifying Phosphorus Retention and Releases in Rivers and Watersheds Using Extended End-Member Mixing Analysis (E-EMMA); Journal of Environmental Quality, 2011)* they state that *"On an annual timescale up to 48% of the P flux was retained for the Sandusky River…. The results suggest that by moving towards cleaner rivers and improved ecosystem health, the efficiency of P retention may*

actually increase."

We have conducted much work on the two-stage ditch concept and the ecosystem benefits of retaining benches in agricultural ditches. In conjunction with Dr. Jen Tank at the University of Notre Dame, ODNR, the TNC, and researchers in Indiana, Michigan, and Minnesota we have demonstrated that two-stage ditches consistently improved N removal potential, while reducing turbidity and sediment export, and improving instream habitat. Additionally, these positive environmental outcomes from the Two-Stage Ditch are either maintained, and even improve, over time without additional ditch maintenance. Our research has lead to the modification of some trapezoidal agricultural ditches to two-stage geometries that are sized based on geomorphic concepts. Currently 30-50 ditches have been modified to a two stage geometry with most of these innovative systems located in Indiana together with a few in Michigan, Minnesota, and Ohio. We have developed an Instream Nitrogen Assimilation Spreadsheet Tool that integrates geomorphology, hydrology and biogeochemistry data to estimate instream nitrogen uptake potential of agricultural drainage ditches and compares an incised trapezoidal ditch system to a ditch with two-stage geometry. A preliminary Instream Phosphorus Assimilation Spreadsheet Tool has been developed in collaboration with ODNR. We have also developed a tool that considers economics of two-stage ditch construction and the University of Minnesota has developed a tool to estimate the return on investment. The two-stage ditch practice has been adopted into the Field Office Technical Guide by the USDA's NRCS in Indiana, enabling it to be used in cost-share programs like the Environmental Quality Incentives Program (EQIP). In 2012, it is anticipated that the USDA-NRCS in Ohio will incorporate it in their Field Office Technical Guide.

In North Carolina and Maryland flashboard risers and other hydraulic control structures have been used in small agricultural ditch systems (often with fields) to provide controlled drainage. In recent years, in these regions, much research has been performed on using industrial waste products (such as iron slag), gypsum and alum in conjunction with a hydraulic control structure to remove SRP, sediment and nitrate nitrogen. Clean out and disposal studies indicate that these are viable approaches that can remove 40% or more of each of the listed constituents. If hydraulic control structures are coupled with the two-stage ditch concept then systems that provide both controlled drainage, a wetland environment and a treatment opportunity could be established.

Internal and External Loads to Lake Erie

We do not have expertise in the complex processes that cause eutrophication and algae blooms in surface water systems. However, we feel that an appreciation of these processes is needed to recognize that it might take many years to achieve an acceptable reduction in these problems and that while actions should be taken as soon as possible they need to be carefully formulated, practical, sustainable, cost-effective, and strive to enhance all aspects of the complex interactions between human activities and nature. An evaluation of the information in the attached appendix suggests that algae blooms (and eutrophication problems) in the Fall and other times of the years are not linked to individual storm events or load accumulations during a particular time of the year. This is not a new finding as Sharpley et al. in a 1994 publication *Managing Agricultural Phosphorus for Protection of Surface Waters: Issues and*

Options note that *"it is assumed that reduction in external loads to a water body will provide immediate reduction in eutrophication status. In many cases reduction in external loads may not translate into immediate benefit to the lake, because of steady release of nutrients from bottom sediments. Long-term nutrient loadings to lakes has resulted in accumulations in bottom sediments, and thus provide a steady source."* Therefore, current problems might be associated with loadings over many years, and perhaps decades, that when coupled with more recent increased loadings of SRP and favorable temperature and wind conditions that have resulted in water bodies throughout that state exceeding critical thresholds that cause algae and eutrophication problems.

Table A. Best Management Practices Effectiveness (multiple sources)

BMP	Variable	Min.	Max	Units	# of Studies
Floodplain Harvesting of Vegetation	DP	0.5	0.5	kg/ha/yr	1
	TP	29	143	kg/ha/yr	2
	PP	--	--	--	--
Instream Wetland	DP	-160	93	%	3
	TP	87	87	%	1
	PP	-263	44	%	3
Bank Stabilization/ Instream Retention	DP	37	83	%	2
	TP	48	59	%	2
	PP	--	--	--	--
Peak Flow Reduction	DP	--	--	--	--
	TP	47	88	%	1
	PP	--	--	--	1

Table B: Best Management Practices Effectiveness (based on Gitau, Gburek and Jarrett, 2005[1] and Merriman, Gitau, Chaubey, 2009[2]).

BMP	Variable	Ave. %	St.Dev. %	Min. %	Max. %	Number Of Studies
Animal waste systems	DP	-13*	71	-117	40	4
	TP	42	24	21	90	7
	PP	59	21	35	72	3
Barnyard runoff management	DP	30	35	5	81	4
	TP	53	23	23	82	7
	PP	33	--	33	33	1
Conservation Tillage	DP	-167	262	-889	73	18
	TP	62	29	-22	95	21
	PP	63	20	15	92	17
Contour strip crop	DP	45	28	20	93	5
	TP	44	25	8	93	22
	PP	60	11	43	76	6
Cover Crop	DP	37	28	7	63	3
	TP	67	--	--	--	1
	PP	--	--	--	--	--
Crop rotation	DP	50	17	30	75	6
	TP	30	--	30	30	1
	PP	65	4	60	70	4
Drainage Water Management	DP	80	--	--	--	1
	TP	1	65	-73	73	9
	PP	--	--	--	--	--
Filter strips	DP	26	25	-56	59	18
	TP	56	18	22	93	23
	PP	41	4	38	43	2
No-till	DP	24	--	--	--	--
	TP	69	--	--	--	--
	PP	60	--	--	--	--
No-till w/ subsurface injection	DP	92	--	--	--	--
	TP	91	--	--	--	--
	PP	38	--	--	--	--
Nutrient management planning	DP	26	41	-66	94	14
	TP	47	24	14	91	9
	PP	46	4	42	50	3
Riparian forest buffers	DP	62	26	28	99	8
	TP	43	36	2	93	9
	PP	84	--	84	84	1
Sediment Basins	DP	80	--	--	--	--
	TP	72	--	--	--	--
	PP	--	--	--	--	--
Stream Fencing	DP	--	--	--	--	--
	TP	75	--	--	--	2
	PP	--	--	--	--	--
Wetland	DP	--	--	--	--	--
	TP	72	2	71	74	2
	PP	--	--	--	--	--

1 Gitau M.W., W.J. Gburek and A.R. Jarrett, 2005. A tool for estimating best management practice effectiveness for phosphorus pollution control. JSWC 60(1): 1-10.

2-Merriman,K.R, M.W. Gitau, and I. Chaubey. 2009. A tool for estimating best management practice effectiveness in Arkansas. Trans. ASABE 25(2):199-213.

Appendix A

Phosphorus in the Lake Erie Basin

Andy Ward (ward.2@osu.edu, December 18, 2011)

(Note: All SRP and discharge data were obtained by the NCWQR at Heidelberg University with kind assistance by Dr Dave Baker)

1. Reducing SRP concentrations to 0.01-0.02 mg/l will require application of several BMPs to provide year round reductions (Table 1).
2. No single approach is likely to reduce concentrations below 0.02 mg/l (Table 1).
3. The annual number of large rainfall and discharge events is increasing (Table 2).
4. SRP concentrations are increasing (Table 3).
5. The majority of the time SRP loads exceed 0.03 mg/l and annual mean SRP loads are approaching or exceeding 0.1 mg/l in creeks and large rivers (Table 3 and Table 4).
6. Large SRP loads are a year round problem (Table 4 and Figure 1).
7. A large majority of the SRP loads occur when discharges are greater than 10% of the 2 year recurrence interval discharge – these discharges approximate bankfull discharges (Table 5).
8. Less than 12% of the SRP loads occur when discharges are greater than the 2 year recurrence interval discharge (Table 5).
9. Peak loads during large discharge events often exceed 0.2 mg/l and depend on the time of year and time of farming practices such as tillage and fertilizer applications (Figure 1).
10. A substantial part (not necessarily the majority) of the discharge is subsurface drainage (Figure 1).

Table 1. Projected SRP concentrations for different initial concentrations and different management and adoption strategies

Concentration (mg/l)	Efficiency (%)	Discharge Conc. (mg/l)	Practice A (50% reduction)	Practice B (50% reduction)	Practice A & B (75% reduction)
100% Adoption					
0.2	40	0.12	0.06	0.06	0.03
	60	0.08	0.04	0.04	0.02
	80	0.04	0.02	0.02	0.01
0.1	40	0.06	0.03	0.03	0.015
	60	0.04	0.02	0.02	0.01
	80	0.02	0.01	0.01	0.005
50% Adoption					
0.2	40	0.12	0.06	0.06	0.03
	60	0.10	0.05	0.05	0.025
	80	0.08	0.04	0.04	0.02
0.1	40	0.06	0.03	0.03	0.015
	60	0.05	0.025	0.025	0.0125
	80	0.04	0.02	0.02	0.01

1. For discussion purposes a 40% efficiency might be the current level, 60% might be a target with the 4Rs and 80% might include some level of additional farming BMPs or use of advanced fertilizer formulations.
2. Practice A might be a cover crop and/or controlled drainage.
3. Practice B might be edge of field treatment (alum/gypsum) and/or wetlands and two-stage ditches

Table 2. OARDC Northwest Branch precipitation trends.

Period	Depth Exceeded (inches)	Events (number)	Events Per Year (number)	Total Depth (inches)	Depth Per Event (inches)
1982-1992	0.5	180	18.0	154.6	0.86
	1	38	3.8	55.6	1.46
10 Yr	1.5	13	1.3	25.7	1.98
	2	4	0.4	10.5	2.63
1992-2002	0.5	198	19.8	181.9	0.92
	1	58	5.8	83.4	1.44
10 Yr	1.5	16	1.6	34.2	2.14
	2	6	0.6	16.8	2.8
2002-2011	0.5	202	22.4	191.0	0.95
	1	63	7.0	95.0	1.51
9 Yr	1.5	22	2.4	47.2	2.14
	2	11	1.2	28.5	2.59

Note the increase in the number of events with more than one inch of precipitation.

Table 3. Percent of time SRP concentrations exceed 0.01 to 0.05 mg/l.

River	Period	SRP (mg/l)				
		0.01	**0.02**	**0.03**	**0.04**	**0.05**
Rock Creek	**1983-2011**	74	57	43	32	24
	2001-2011	84	70	56	43	35
Honey Creek	**1976-2011**	88	79	69	59	49
	2001-2011	94	88	80	71	63
Sandusky	**1974-2011**	75	66	58	50	42
	2001-2011	82	74	67	61	55
Maumee	**1975-2011**	80	73	67	62	55
	2001-2011	83	78	73	68	63

Note that for the three largest rivers SRP concentrations exceed 0.05 mg/l more than 50% of the time.

Table 4. Monthly SRP loads and discharges for three Lake Erie Basin rivers.

River	Constituent	Units	January	March	May	July	September	November	12 Month Mean/Total
Honey Creek	**Flow Weighted Conc.**	**mg/l**	0.13	0.15	0.13	0.16	0.23	0.22	**0.15**
10/1/2010 - 9/30/2011	**Total Load**	**1000 kg**	0.5	7.4	5.3	1.2	2.4	1.7	32.2
	Total Discharge	**1000 cfs-days**	1.7	20.4	17.0	3.1	4.3	3.2	86.0
Honey Creek	**Flow Weighted Conc.**	**mg/l**	0.11	0.06	0.14	0.10	0.08	0.20	**0.11**
10/1/2005 - 9/30/2006	**Total Load**	**kg**	3.7	0.5	1.9	0.4	0.0	1.2	14.9
	Total Discharge	**cfs-days**	13.3	3.5	5.9	1.4	0.2	2.5	54.5
Sandusky River	**Flow Weighted Conc.**	**mg/l**	0.06	0.12	0.09	0.11	0.12	0.08	**0.10**
10/1/2010 - 9/30/2011	**Total Load**	**kg**	14.2	58.8	33.1	17.7	18.7	1.5	210.1
	Total Discharge	**cfs-days**	102.4	202.7	154.3	63.4	63.5	7.3	904.0
Sandusky River	**Flow Weighted Conc.**	**mg/l**	0.11	0.06	0.10	0.11	0.07	0.12	**0.09**
10/1/2005 - 9/30/2006	**Total Load**	**kg**	26.8	4.3	13.0	9.8	1.0	6.5	112.1
	Total Discharge	**cfs-days**	100.9	31.5	54.5	37.2	5.8	21.5	506.2
Maumee River	**Flow Weighted Conc.**	**mg/l**	0.100	0.10	0.09	0.01	0.06	0.01	**0.09**
10/1/2010 - 9/30/2011	**Total Load**	**kg**	18.4	154.8	164.5	0.4	14.9	1.0	537.3
	Total Discharge	**cfs-days**	74.8	629.5	753.5	11.7	94.8	30.3	2,532.8
Maumee River	**Flow Weighted Conc.**	**mg/l**	0.09	0.06	0.08	0.08	0.03	0.12	**0.08**
10/1/2005 - 9/30/2006	**Total Load**	**kg**	36.3	29.9	63.0	15.5	3.1	35.9	314.3
	Total Discharge	**cfs-days**	168.0	199.7	320.2	77.6	37.8	121.2	1,613.8

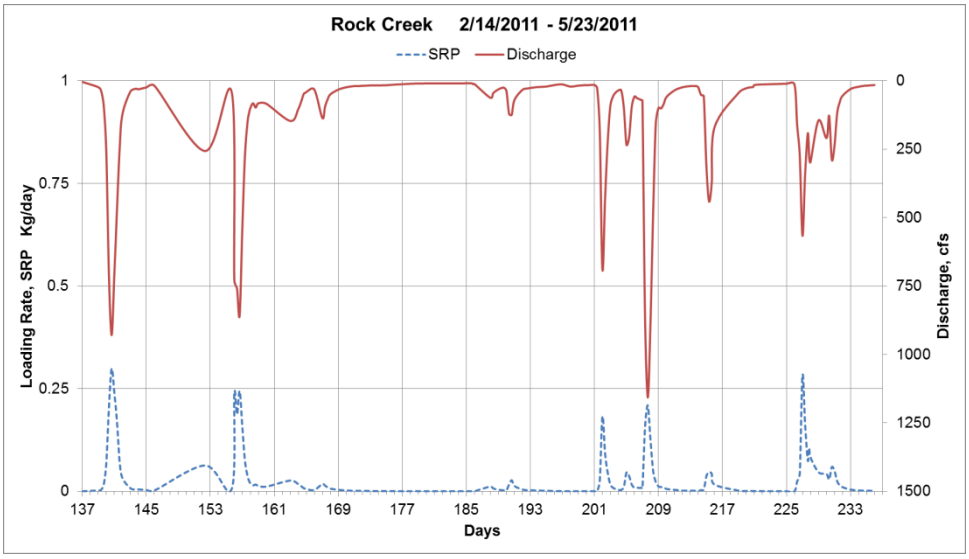
Note that the highest discharges and load are in the spring but very high concentrations also occur in the fall and winter.

Table 5. Discharge magnitude, percent time discharge is exceeded and percent of SRP loads for different recurrence interval discharges.

River Drainage Area	Attribute		Recurrence Interval				
			10% of 2 Yr	20% of 2 Yr	50% of 2 Yr	2 Yr	5 Yr
Rock Creek	Discharge	cfs	127	254	635	1270	1850
34.6 mi^2	Load	%	73.5	56.7	29.6	7.8	2.3
	Time	%	5.5	2.9	0.8	0.1	0.02
Honey Creek	Discharge	cfs	260	520	1300	2600	3450
149 mi^2	Load	%	81.1	64.2	29.4	7.7	2.3
	Time	%	14	7.5	1.8	0.3	0.07
Sandusky	Discharge	cfs	1550	3100	7750	15500	20800
1253 mi^2	Load	%	85.2	72.2	41.7	12	5.8
	Time	%	20.9	11.9	3.7	0.5	0.2
Maumee	Discharge	cfs	5170	10340	25850	51700	69900
6330 mi^2	Load	%	84.4	67.5	33.4	9.5	3.7
	Time	%	30	16.2	4.5	0.7	0.2

Note: In ditches the inset channel associated with benches (small floodplains) can convey discharges associated with 10-50% of the 2 year recurrence interval discharge – this approximates what is called the bankfull discharge. In Ohio's rivers nature would like to have floodplains at an elevation where the main channel can convey about 25-75% the 2 year recurrence interval discharges. Therefore, in both ditches and rivers out-of-channel discharge, on to vegetated benches/floodplains if present, occurs when the bankfull discharge is exceeded. Sediment, nitrogen, total P, and SRP loads will reduce when these out-of-channel discharges occur (unpublished results of collaborative research with Jen Tank at the University of Notre Dame).

Figure 1. Rocky Creek 2011 discharge events (peak concentrations for all large events 0.10-0.28 mg/l). December concentrations (not shown) have exceeded 0.6 mg/l.



Note: Rock Creek has a drainage area of 34.6 square miles, a length of about 33 miles and an average slope of 7.07 feet per mile. At bankfull the flow velocity is about 2 miles/hour and it would take 16 hours for flow to travel the length of the creek. If there was only surface runoff the time to the peak discharge would be less than 12 hours from the centroid of the precipitation hydrograph. Typically, it was longer than this and high discharges occurred fo