U.S. ENVIRONMENTAL PROTECTION AGENCY

Farm, Ranch, and Rural Communities Committee Report

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TABLE OF CONTENTS

I. Executive Summary…………………………………………………… 1

II. Partnerships Workgroup Report………………………………………. 13

III. Resources Workgroup Report………………………………………… 29

IV. Science Workgroup Report…………………………………………… 41

A. Appendix A……………………………………………………….. 51

1. Attachment A……………………………………………… 67

2. Attachment B……………………………………………… 69

B. Appendix B.………………………………………………………. 73

C. Appendix C……………………………………………………….. 77

I. EXECUTIVE SUMMARY

FRRCC REPORT – EXECUTIVE SUMMARY

INTRODUCTION

The Environmental Protection Agency's Farm, Ranch, and Rural Communities Committee (FRRCC) has concluded over a year of evaluation of EPA efforts to restore, maintain, and enhance water quality through nutrient management programs. Among the key findings are a need for more public engagement, more effective two-way communication with the agricultural community, and refinement in the application of science with respect to the water quality programs it oversees.

In the agricultural community, EPA's role is often seen as the enforcer of overly restrictive regulatory policy and thus the Agency is treated with suspicion. However, to the Agency's credit, EPA has shown a willingness to maintain and advance an open dialogue with key stakeholders on how to address agricultural nonpoint source pollution; has created a proposed framework for State nutrient reductions that encourages partnerships, flexibility, innovation, and better targeting; and has expressed a desire to encourage market-based tools where appropriate to improve the cost-effective clean-up of impaired watersheds. Such actions, along with the additional recommendations detailed in this report, will help the Agency move forward with the public and private support it needs to accomplish its mission. What follows is a summary of the critical review by EPA's FRRCC and its recommendations on how the Agency can more effectively accomplish its goals related to maintaining and enhancing the nation's water quality, specifically addressing the role of agriculture in achieving water quality goals.

While three workgroups established by the FRRCC independently developed recommendations in the areas of Science, Resources, and Partnerships, overarching themes emerged from all three groups. First, establishing timely dialogue between the Agency, its partners, and the public will strengthen trust, as shown by many examples in the report. The workgroups identified steps to improve trust and success through better science, more meaningful partnerships, and effective two-way communication. Second, agricultural landowners and operators are in a unique position to voluntarily engage in conservation behaviors that provide multiple ecosystem services and enhance water quality more efficiently and cost effectively than mandatory rules and litigation. The Agency can catalyze voluntary actions by producers by continuing to support the development of certainty agreements by States to encourage and acknowledge an appropriate level of stewardship by agricultural producers. Third, the workgroups felt it was vitally important for EPA to continue to be sensitive to underserved groups including limited-resource and minority farmers, and to work in collaboration with 1890s, 1994s, Hispanic colleges, and community- based organizations to address the educational and remedial needs of this growing segment of the farm community. And finally, the workgroups reaffirmed their support for the use of voluntary conservation practices by agricultural producers and felt it was important for EPA to continue to recognize the value of these practices in achieving environmental goals.

FRRCC Background and Charge

Recognizing the unique challenges and opportunities of agricultural nonpoint source pollution, the Environmental Protection Agency (EPA) established the Farm, Ranch, and Rural Communities Committee (FRRCC) as a federal advisory committee in 2008 to provide independent policy advice, information, and recommendations to the Administrator on a range of environmental issues and policies that are of importance to agriculture and rural communities.

FRRCC REPORT – EXECUTIVE SUMMARY

In February 2010, the Agency renewed the FRRCC's current charter to make recommendations to the Agency on the most effective approaches to addressing water quality issues associated with agricultural production during the current chartering cycle. Following a request for applications in the Federal Register, the FRRCC's current membership was appointed in May 2010 by the EPA Administrator and consists of 29 members representing academia, industry (e.g., agriculture and allied industries), non-governmental organizations, and state, local, and tribal governments. The FRRCC was charged with developing a report encapsulating their experience and perspective on these issues by early 2012.

Summary of Recommendations

The recommendations summarized below are discussed in more detail later in the Executive Summary.

- EPA should ensure that nutrient criteria and new suspended and bedded sediments (SABS) criteria developed by states or, where appropriate, by EPA are science-based and rely upon a clear cause-effect relationship. EPA should use adaptive management to inform the ways in which nutrients and SABS can be managed most effectively to reduce off-site movement into waterways.[1]

- EPA should always use the EPA Guidelines for Preparing Economic Analyses, and ensure that they are updated as appropriate.

- EPA should develop a coordinated public engagement plan to exchange information on agricultural and environmental issues.

- EPA should ensure it has adequate staff with resources to work effectively in the field with agriculture on environmental issues, specifically Regional Agricultural Advisors, Strategic Agricultural Initiative-like specialists, and EPA-Land Grant University liaison positions in all EPA Regions.

- EPA should work proactively with agriculture to address water quality issues early and often, and continue to encourage and support state certainty programs, especially with respect to stewardship.

- EPA should continue to improve the effectiveness and reach of currently available resources by leveraging resources with others, including State and Federal conservation programs, Section 319 funds, USDA National Institute of Food and Agriculture (NIFA) opportunities, state revolving funds, private foundation funds, and private markets.

- EPA should enable and provide resources for a multi-entity, multi-disciplinary partnership to develop and use tools and protocols for improved measurement, documentation, and verification of water quality benefits from agricultural practices and

[1] Discussions in Committee deliberations of adaptive management focused on better use of data and information to evaluate current management practices and strategies and to improve implementation at the farm and field level.

strategies, and to improve the use of resources for the development and delivery of critical best management practices.

- EPA should convene, support, and facilitate a multi-entity, multi-disciplinary partnership to evaluate and advance more effective approaches to delivering real improvements to nutrient management and other critical conservation practice efforts, and to advance more effective use of federal and state resources invested in conservation programs.

PROCESS

Committee Process

In the development of this report, the FRRCC held four public meetings in the Washington, DC area and consulted with a broad range of technical experts, program managers, and decision-makers both within and outside the Agency to inform its findings and recommendations.

The FRRCC's first three meetings were predominantly focused on gathering information. At its first meeting on September 30 - October 1, 2010, the Committee was addressed by Administrator Lisa P. Jackson and Deputy Administrator Bob Perciasepe, and also received an overview of water quality issues as they relate to agriculture from the EPA Chesapeake Bay Program Office. Members were also given specific information about agricultural water quality issues through regional case studies to inform their discussions and ultimately, their recommendations. Three distinct geographic areas were covered at this meeting: the Chesapeake Bay, the Mississippi River Basin, and Florida.

The FRRCC held a second meeting on March 29-30, 2011, where members learned more about specific water quality issues facing three additional geographical areas: the Great Lakes, the California Bay Delta, and the Puget Sound. The FRRCC also received an overview of USDA Conservation Programs, and began to discuss overarching themes and goals for its final report. At the FRRCC's third meeting on June 22-23, 2011, the members invited various stakeholders and experts involved in agricultural water quality issues to discuss their perspectives and further inform the Committee's discussions and findings. The FRRCC heard presentations from various speakers over the course of the meetings described above. A list of all presenters and topics from these three meetings is attached.

While the FRRCC engaged in deliberations collaboratively and made decisions collectively whenever possible, the Agency did not request consensus-based recommendations from the Committee since some good ideas may not be unanimously agreed upon, and there is value in hearing differing points of view on an issue where there is not agreement. Notwithstanding that fact, there was broad agreement and support for the vast majority of the recommendations expressed in the attached Workgroup reports.

Committee Deliberations

In its initial deliberations, the Committee identified several overarching principles that are important to consider in the process of developing and implementing measures to conserve and protect water quality:

- Credibility
- Flexibility
- Technical Feasibility
- Economic Viability
- Environmental Soundness
- Transparency

The Committee also identified three main topic areas – Science, Resources, and Partnerships – to serve as a structure for its deliberations and, ultimately, for the FRRCC's report to the Agency. To further those discussions, the Committee established three workgroups around those topics. These workgroups spent considerable time over three meetings in discussions and collecting information. (The full deliberations of the workgroups, along with detailed recommendations, are enclosed in the attached Workgroup reports).

The **Science Workgroup** was tasked with an evaluation of the science-based process of discovery with regard to water quality policies. Specifically, the Workgroup was asked to: 1) identify key areas of influence within the science-based process; and 2) make recommendations to EPA on how to better inform the policy development process with science-based information. The Science Workgroup separated its charge into three functional areas: modeling and standards, economics, and communication.

- The *model and standards* subgroup assessed: 1) how nutrient and suspended and bedded sediments criteria and standards are being established; 2) model uncertainties and the role of modeling in this process; and 3) the links of models and standards to biological impacts on water quality and management solutions. In its discussions with EPA scientists as well as policymakers, state regulators, academic experts, and the affected farming community, the subgroup members noted that a lack of confidence exists among some stakeholders in:
    - the representation of Best Management Practices (BMPs) in models and documentation of BMP efficacy in meeting water quality goals;
    - the feasibility of improved linkages across models to more accurately characterize a region on a water quality issue; and
    - the connection between the appropriate biological condition (water quality goals) and the standards EPA sets to achieve its goals.

- The *economic analysis* subgroup sought to address data, scope, and methodological considerations in analyses as well as timing, team building, and collaborations relating to the economics of policy development and policy implementation. The subgroup deliberations noted that many issues impact the reliability and relevance of economic analyses to the policy-making process. Some of these issues are: 1) existence and use of consistent guidelines for economic analyses; 2) timing and triggering of economic analyses; 3) expertise and other collaborative requirements; and 4) scientific peer review.

- The c*ommunication* subgroup addressed: 1) alignments and links across agencies in sharing science information; 2) linkages and information flow regarding science from agencies to producers and flow of information back to agencies from producers regarding

BMP effectiveness; and 3) other policy relevant information. Effective communication for improvements to water quality requires that high quality data (scientific and economic) be generated and shared at an early stage with appropriate stakeholders in the scientific and agricultural communities.

The **Resources Workgroup** was tasked to: 1) consider the resources necessary to help agricultural producers address water quality problems related to the runoff of nutrients from their farming operations; and 2) provide recommendations to EPA on how to more effectively allocate and manage its resources to address this challenge.

The Resources Workgroup began with the premise that local, state, and federal budgets will continue to face significant cuts, and many of the funds that traditionally have helped farmers and ranchers implement conservation practices may no longer be available. This means that EPA and its partners will need to target their remaining resources to sources that contribute disproportionately to water quality problems, and will need to act proactively in watersheds to achieve water quality improvements.

Although strategic targeting can help stretch limited resources, the Workgroup emphasized the continued need for adequate resources (people, money, and time) to provide technical, educational, and financial assistance to effect and sustain positive change. In its discussions, the Workgroup noted that with broader vision, knowledge, and resources, farmers and ranchers will, in greater numbers, voluntarily make management decisions and adopt and sustain behaviors that will result in reduced pollutant loads to surface and ground waters. To achieve this shift, the Workgroup discussed the types of resources needed (financial, technical, and educational), who needed them (producers, students, regulators), and at what level they were needed (state, community, farm).

Finally, the Workgroup considered how the Agency could most effectively leverage its resources and influence the allocation of resources by others to accomplish the goal of improving water quality. The Workgroup identified ways the Agency can more effectively deploy and utilize its staffing resources, how the Agency can work more proactively with agriculture, including ways it can encourage and support economically achievable state certainty agreements, and how the Agency can continue to improve the effectiveness and reach of currently available resources by leveraging resources with others.

The Partnerships Workgroup discussions recognized that partnerships can be a very effective way for EPA to facilitate and accomplish positive change in agricultural water quality, especially in light of the limited statutory authority the agency has over agricultural operations. This strategy is not new to EPA and, in fact, there are numerous examples of successful partnerships between EPA and agriculture, industry, and various interest groups. The Workgroup members gathered, reviewed, and discussed several of these examples and others outside the Agency as a means of identifying key factors for why and how partnerships can enhance efforts to address problems.

Key factors to be considered in deploying partnerships as a core strategy include:

- The investment in building trust predicated upon mutual respect and deference in appropriate circumstances;

- Different roles and how to identify the best role to support partnership;
- Mechanisms essential for supporting partnerships; and
- The best contexts in which partnerships can be successful.

The scope of partnerships can range from national to regional to state to local, and EPA can play various roles in the partnership depending on the nature of the issues. Because the vast majority of natural resource impacts associated with agriculture are non-point in nature, the Workgroup discussed the need for EPA to increase its attention to and support of partnership approaches to effectively advance agricultural water quality goals. In order to make more meaningful, lasting, and significant impacts across the landscape, the Workgroup identified three areas where partnerships can increase the effectiveness of and foster more rapid and sustained implementation of solutions to water quality challenges:

- Partnerships to advance collaborative research to better understand the science behind challenges and opportunities and to support collection of better data from which to develop solutions;
- Partnerships to discuss and resolve an agricultural water quality impairment issue; and
- Partnerships to implement agricultural water quality solutions.

The Workgroup also noted that agricultural certainty was another issue around which EPA should leverage a partnership approach, which could play in increasing adoption of conservation measures by farmers.

RECOMMENDATIONS

Science Workgroup Recommendations

Effective water quality management relies on the science-based process of discovery. That process must not only address the technical issues of cause and effect, but also fully analyze the economic implications of policy decisions. Open and effective communication is a key component that helps to inform the science and to implement policy. EPA has the opportunity to adopt a comprehensive, interactive, and flexible approach to science-based water quality regulation and strengthen the process of continuous improvement through adaptive management. To this end, the Science Workgroup recommends that the Agency take the following steps:

- **Ensure that nutrient criteria and new suspended and bedded sediments (SABS) criteria developed by states or, where appropriate, by EPA are science-based and demonstrate that the nutrient or sediment in fact causes an adverse biological effect on the designated use for the water body.**
    - Use a weight of evidence approach (e.g., use more than one model, document model uncertainties, calibrate to the size and class of the water body, and account for confounding factors) to develop the science-based criteria.
    - Update guidance on nutrient criteria development to take into account key science advisory board and science peer review recommendations.
    - Building on the 2006 EPA Framework, develop guidance on SABS criteria.

- **Use adaptive management as a management tool to mitigate the movement of nutrients and SABS off-site from agricultural operations to water.**
    - Use USDA Conservation Effects Assessment Project (CEAP) studies to identify and quantify the effectiveness of BMPs and emerging technologies being employed on farms and ranches to reduce agricultural nutrient and SABS loads.
    - Partner with USDA's Natural Resources Conservation Service (NRCS) to link CEAP studies to 303(d) lists to help identify vulnerable lands in watersheds.
    - Partner with USDA NRCS and Farm Service Agency (FSA) to help target USDA conservation programs for water quality improvement.
    - Provide guidance to USDA and land grant institutions on EPA priorities for additional research on BMPs. New technologies and new varieties with improved nutrient use efficiency are critical to improving on farm efficiencies.

- **Adopt consistent use of the EPA Guidelines for Preparing Economic Analyses.**
    - Foster collaboration across disciplines, agencies, and the private sector during the development of an economic assessment to facilitate relevance and reduce omission of important considerations in the analysis.
    - Subject analyses related to EPA regulatory action to a timely, independent, and transparent review to ensure a peer-reviewed, validated, science-based process and facilitate interpretation of results and comparison across studies.

- **Develop a coordinated public engagement plan at the national, regional, and local levels to exchange information on agricultural and environmental quality issues.**
    - Identify and reach out to key leaders (state and local grower associations, land grant extension, tribes, and other key leadership) early in the process to notify industry about a water quality issue.
    - Develop appropriate outreach materials to explain the science behind practices, impacts, and water quality goals.
    - Instruct the EPA Regional Administrators and Regional Agricultural Advisors to establish a process to coordinate data sharing across agencies and other stakeholders.
    - Demonstrate BMPs at the farm level to facilitate understanding of the connection between action and impact on water quality.

<u>Resources Workgroup Recommendations</u>

With significant cuts to a variety of funding sources likely, EPA needs to make the most efficient and effective use of the resources remaining. Along these lines, EPA should: apply resources commensurate with the challenges of non-point source pollution; assign staff with excellent technical and customer skills dedicated to this task; and strengthen traditional partnerships and expand into non-traditional relationships to leverage EPA resources more strategically. To do this, the Resources Workgroup recommends that EPA take the following steps:

- **Ensure adequate staff are available with resources to work effectively in the field with agriculture on environmental issues, help catalyze effective technology transfer**

to agricultural producers, and connect more effectively to the Land Grant Universities.

- Create and maintain full-time Regional Agricultural Advisor positions which report directly to the Regional Administrator in all ten EPA Regions.
- Re-establish the IPM Strategic Agriculture Initiative (SAI) model with SAI specialists in the Regions focused on reducing nutrient impairments.
- Expand support of the EPA-Land Grant University (LGU) Liaison positions in all EPA Regions and work with the LGUs to provide salary and adequate travel budget.

- **Work proactively with agriculture to address water quality issues.**
    - Encourage opportunities with institutions, organizations, and universities (e.g., LGUs, state universities, private colleges, non-profit organizations, etc.) to develop effective technology transfer programs.
    - Engage watershed stakeholders before planning regulatory actions to encourage voluntary local action, discuss possible solutions, and convene key stakeholders to better align resources to address the problems.
    - Develop and support integrated training for EPA employees to increase their effectiveness in working with farmers.
    - Invest in developing curricula through partnerships with LGUs and community colleges that address regulatory issues facing agriculture, for both agriculture and natural resources students.

- **Continue to encourage and support State certainty programs.**
    - Work with States to establish a reasonable level of stewardship and develop uniform checklists to assess a farm's operation and management against this reasonable level of stewardship.
    - Consider how best to incorporate a "reasonable level of stewardship" into the TMDL process.

- **Increase the effectiveness and reach of currently available resources by leveraging resources with others.**
    - Use Section 319 funds to help States develop reasonable levels of stewardship for certainty agreements, strategically waive the 40 percent cost-share requirement if necessary, and work with State and federal conservation programs and USDA NIFA to coordinate water quality funding opportunities.
    - Expand the use of State Revolving Funds to establish wetland mitigation banks and use the proceeds from the sale of the resulting credits to reimburse the SRF loan or purchase development rights on farmland.
    - Reach out to private foundations to explore aligning private sector resources more effectively with Agency efforts.
    - Leverage private sector efforts to establish performance metrics for agriculture to meet its water quality challenges.
    - Continue to encourage ecosystem services markets by providing guidance to the States on ways to support markets and improve water quality in advance of regulatory drivers.

Partnerships Workgroup Recommendations

Partnerships are especially critical for EPA in addressing water quality issues:
1) The diffuse and complex nature of non-point source impacts necessitates working at the appropriate watershed level, and thus with the many entities in that watershed.
2) Given limited resources, partnerships can help and are critical to leveraging funding, expertise, and people.
3) Developing consensus on science necessitates having the key stakeholders, especially agricultural stakeholders, at the table.

The Partnerships Workgroup recommends that EPA pursue the following specific partnership strategies to increase the pace and success of overcoming some of today's most pressing water quality challenges related to agriculture:

- **Enable and provide resources for a multi-entity, multi-disciplinary partnership to develop and use tools and protocols to improve measurement, documentation, and verification of water quality benefits from agricultural practices and strategies.**
    - Charge partnership to coordinate existing efforts to research, develop, and pilot technical tools, such as farm-level tools for evaluating the effectiveness of nutrient management and other best management practices.
    - Ask partnership to facilitate the evaluation and adaptation of tools to improve their performance.
    - Encourage partnership to engage non-traditional disciplines, such as robotics engineers and IT developers to provide more user-friendly tools.

- **Foster and support a multi-entity, multi-disciplinary partnership to improve the use of resources for the development and delivery of critical best management practices.**
    - Dedicate a portion of 319 resources to build watershed-level capacity to develop plans and projects that will improve water quality.
    - Develop partnerships with states to implement science-based, economically achievable, best management practices.
    - Develop and provide funding for active outreach strategies to disseminate information and lessons learned from 319 and other watershed projects and require projects to deliver findings and recommendations to partners and agencies as a component of grant funding.
    - Establish prizes to incentivize development of improvements to existing conservation practices and development of innovative practices and technologies. Prioritize improved effectiveness of nutrient management, improved documentation of cover crop effectiveness, and more optimal and effective placement of filtering practices.

- **Improve support for and visibility of the role of EPA's Regional Agriculture Advisors.**
    - Increase and better coordinate communications with regional agricultural partners on relevant EPA activities and dedicate time for meeting and interacting with producers and stakeholders in the field on an on-going basis.

- Collaborate with regional partners to identify the top three agricultural resource conservation issues in the region and facilitate partnership approaches to develop and implement solutions to those issues.
- Create and support improved tools for communicating the activities of the Regional Agricultural Advisors, including more effectively designed and user-friendly online information and web pages.

CONCLUSIONS

The FRRCC saw its mission as an opportunity to investigate how the EPA develops and implements water quality rules related to agriculture, and to provide insights that could improve water quality across the U.S.

Our deliberations uncovered critical and complex interactions between agriculture and the environment, as well as a wide range of policy and technical issues that can span entire regions, watersheds, and production systems, along with the federal, state, and local regulatory frameworks that govern them. Agricultural landowners and operators are in a unique position to voluntarily engage in conservation practices that provide multiple ecosystem services and enhance water quality more efficiently and cost effectively than mandatory rules and litigation. The FRRCC felt it was important for EPA to continue to recognize the value of these practices in achieving environmental goals.

The willingness the Agency has shown in maintaining and advancing an open dialogue with key stakeholders on how to address agricultural nonpoint source pollution is a critical first step. The FRRCC identified and recommends a number of additional steps the Agency can take to improve trust and success through better science, to create more meaningful partnerships, and to establish more effective two-way communication with the agricultural community. The FRRCC believes its recommendations will minimize and mitigate private frustrations, improve EPA's credibility, and foster increased trust. If EPA couples the positive efforts it is already undertaking with action on the FRRCC recommendations, we believe this will enhance the perception and substance of the Agency's role.

II. PARTNERSHIPS WORKGROUP REPORT

FRRCC PARTNERSHIPS WORKGROUP REPORT

I. Introduction

Agriculture in the United States utilizes science-based production practices, advanced technology, and conservation practices to produce food and fiber for the US and much of the world. According to the National Cattleman's Beef Association, advanced technology allows one farmer to currently feed 129 people. In 1960, one farmer fed 25 people. As demand for food and fiber around the world has increased American agriculture has responded with increased production of safe, wholesome food. The same technological advances that have increased productivity have also reduced the impact of farming on the environment and natural resources. As the world population continues to grow the need to advance agricultural production practices is paramount. Not only do we have to increase production, but do it on fewer available acres with less impact on natural resources.

Partnerships have been a critical driver of much of the progress that has been made in American agriculture. In 1862, the Morrill Act established the Land Grant Universities and subsequent agricultural extension programs to advance the science of agriculture and convey that knowledge to young people and producers. Cooperatives were instrumental in bringing electricity and telephone service to rural America. Even today, farmer cooperatives are used for sourcing farming supplies and marketing farm products. Agriculture has a long history of working in partnerships with land grant universities, USDA's Natural Resources Conservation Service, Farm Service Agency, and Extension Service, and with other farmers. It seems only logical that we would advance the conservation of natural resources and especially water quality in that same way.

In addressing water quality challenges associated with agriculture, partnerships can and must play a central role if we are to make meaningful progress. Partnership development should include all stakeholders, from the farm level to state and federal agencies and organizations, thus ensuring buy-in at all levels. Partnerships offer a path to bring together common values and potentially synergistic authorities and resources.

There are a number of reasons why addressing water quality challenges from nonpoint sources are both especially well suited to and in need of partnership approaches and why there is unique value to EPA as an agency as it pursues its mandate to achieve the goals for the nation's waters:

1. If we are to meet the ever increasing demand for food and fiber, agriculture has to play a key role in any changes to the production system. They are the people with profound knowledge about the system that is being discussed.
2. In order to have a meaningful impact on the diffuse nature of nonpoint source impacts to water quality, strategies and approaches must be developed and implemented at the watershed level. Working at the scale of a watershed means there are many entities involved and impacted, often crossing jurisdictional boundaries. The only viable way to make meaningful progress in changing management across so many stakeholders is through collaboration and partnership.
3. In a world of limited resources, the ability to leverage funding, expertise, and people to get the job done from a diversity of partners dramatically increases EPA's ability to advance water quality goals and address nonpoint source pollution.

4. The issues related to agriculture are too complex, and the systems and practices that must be implemented at the ground level too diverse, for a one-size-fits-all approach to deliver the sustained improvements we all seek in protecting natural resources while supporting an economically vibrant agricultural economy. A partnership approach can overcome a one-size-fits-all approach by bringing local expertise to the table and fostering the diversity of opinion and experience to tailor approaches to the particular situation or need.
5. EPA brings unique expertise and reach that can motivate, coordinate, and or fund partnership initiatives. Few other agencies combine the access to scientific expertise, ability to work at all levels from local to national, and ability to provide or leverage funding. If not connected into a partnership framework and approach, EPA's strengths will not be used as effectively as possible because they will fail to connect to the important players on the ground and possibly create division instead of collaboration.
6. Consensus on science is fundamental to development of viable strategies. Without concensus on the science of the problem, even the best solutions can fail because those who must make the changes are not on board. The best way to generate concensus on issues of science is to have the key players at the table, which is best accomplished through partnerships. Furthermore, pursuing a partnership approach to have key stakeholders on board would reduce the risk of litigation.
7. EPA's limited success with unilateral resource-intensive initiatives underscores the need to explore alternative methods to reduce pollution from agricultural sources.

The necessity for EPA to increase its attention to and support for partnership approaches to advance agricultural water quality goals stems largely from the fact that the vast majority of natural resource impacts associated with agriculture are non-point in nature. Agriculture is a biological system, one that is extremely varied and unique from farm to farm, from watershed to watershed, and from state to state. It is not only the type and size of farm that creates this complexity and diversity, but the nature of the landscape itself – climate, hydrology, topography, soils, and more.

In order to make more meaningful, lasting, and significant impacts across the landscape, we recommend that EPA focus on three areas in particular for advancing partnership approaches to water quality challenges:

- Partnerships to assess and define the water quality issue (once an issue has been identified , a partnership can advance collaborative research to better understand the challenges and opportunities and support collection of data from which to develop solutions);
- Partnerships in the discussion and resolution of an agricultural water quality impairment issue; and
- Partnerships to implement agricultural water quality solutions.

We believe these three areas are in greatest need of EPA-supported collaborative approaches and are especially well suited for EPA attention and engagement. In addition, we believe there is a significant need to generally foster understanding and trust between the agricultural community and representatives of the agency. Establishing FRRCC-like groups at the regional level could encourage information exchange and more collaborative approaches to addressing environmental issues**.** EPA's agricultural advisors in each region could coordinate and lead these efforts.

An additional issue around which EPA should leverage a partnership approach is that of agricultural certainty. There is significant interest of late in developing provisions and guidelines for agricultural certainty in light of increasing pressure and need for making progress in advancing water quality goals related to agricultural production. USDA and EPA at the federal level, as well as many at the state level, are interested in the role that regulatory certainty could play in increasing adoption of conservation measures by farmers. It is critical that discussions around agricultural certainty provisions bring to the table the diversity of stakeholders with expertise and interest in the issue to ensure that regulatory certainty follows a path to providing an important additional incentive and benefit for farmers to participate in BMP programs.

We recommend that EPA use a partnership approach to help states, in particular by collaborating with states and key stakeholders to develop a set of guidelines or principles on regulatory certainty that interested states could utilize. Working with state and nongovernmental partners, including agricultural and conservation organizations and land grant universities, EPA should:

- Help interested states develop regulatory certainty provisions within the context of their individual nonpoint source pollution/BMP programs;
- Encourage states to test and evaluate the effectiveness of these provisions first on a pilot basis in priority watershed(s); and
- Encourage states to further enhance appeal to farmers/agricultural landowners by combining agricultural certainty with other measures, such as priority for technical assistance or grant funding and providing signs to display.

II. <u>Summary of Workgroup Deliberations</u>

As mentioned above, the Partnerships Work Group was one of three established workgroups of the EPA's Farm, Ranch, and Rural Communities Advisory Committee (FRRCC). The Partnerships Workgroup met in person during three of the plenary sessions and held several work group phone calls in order to conduct their deliberations and develop preliminary recommendations to propose to the full FRRCC for consideration. Partnerships Workgroup members conducted the following steps:

- Identified and evaluated case examples of partnerships;
- Highlighted characteristics of successful partnerships;
- Identified different roles for EPA in fostering effective partnerships;
- Determined key opportunities for applying partnership strategies for addressing environmental issues associated with agricultural production; and
- Developed specific recommended partnerships to better address water quality issues associated with agricultural production, and determined the role EPA can best play in establishing these partnerships.

Highlights of these deliberations, including observations and insights on how EPA can successfully partner with agricultural production stakeholders and the various roles the agency can play in establishing and fostering such partnerships are discussed below. Specific recommendations developed by the Partnership Workgroup members are in the next section.

III. Main Observations and Insights

Partnerships can be a very effective way for EPA to facilitate and accomplish positive change in agricultural water quality, especially in light of the limited statutory authority the agency has over agricultural operations. This strategy is not new to EPA and, in fact, there are numerous examples of successful partnerships between EPA and agriculture, industry, and various interest groups. The Workgroup members gathered, reviewed, and discussed several of these examples and others outside the agency as a means of identifying key factors for why and how partnerships can enhance efforts to address problems. Key factors to be considered in deploying partnerships as a core strategy include 1) the investment in building trust predicated upon mutual respect and deference in appropriate circumstances, 2) different roles and how to identify the best role to support partnership, 3) mechanisms essential for supporting partnerships, and 4) the best contexts in which partnerships can be successful. The scope of partnerships can range from national to regional to state to local, and EPA can play various roles in the partnership depending on the nature of the issues.

Below are observations and insights from the Partnerships Workgroup on how best to establish and structure successful partnerships as a strategy for effectively addressing water quality issues that include an agricultural production component. Examples are offered to highlight the different roles EPA can play in establishing, fostering, or managing partnerships.

1. Trust is a critical ingredient for successful partnerships

The most important ingredient in any successful partnership is trust between the partners. In all cases, it is critical that EPA work to bring all key partners to the table and lay a foundation of cooperation and communication. A good beginning is for the Agency representatives to provide clarity on ground rules and define the Agency's role so that other stakeholders will understand key parameters and constraints and begin to develop trust – in the process and with EPA. EPA must clearly define and communicate any statutory requirements, any criteria to meet standards, and any areas where EPA has flexibility. In the end, all collaborating entities must believe in the process and a fundamental requirement is trust that all of the partners are putting forward a good faith effort to achieve the desired goals within the established parameters. EPA can play a pivotal role in setting the example and tone for building this trust. While EPA may have the statutory authority to act, it could conserve resources and engender trust by allowing partners with complementary capabilities to undertake some program elements.

2. Different roles for EPA

EPA can play a variety of roles in shaping and fostering strong partnerships to address water quality issues associated with agricultural production. To be most successful, EPA should determine what the most effective role for them will be in different situations. The right role will vary depending on a number of factors, including the particular technical challenge, regulatory requirements, time line to address the issue, the scale of the issue and associated number and types of expertise need to address the problem, the availability and willingness of partners, and other considerations. Among the many roles EPA could play, the obvious ones are: 1) facilitator, 2) stakeholder, and 3) lead.

a. EPA as the lead

EPA can be the lead in establishing and organizing partnerships. As the leader, it would be EPA's responsibility to convene interested parties in a partnership. In this role, it is especially incumbent on EPA to ensure transparency in the goals and objectives of the partnership and ensure the best information available is provided to the stakeholders for deliberation. EPA has a great opportunity to shape the outcome of the partnership; however, it must be done in such a way that other stakeholders do not feel that the process is completely driven by the Agency. This perception could erode trust. As a lead, EPA can also play a non-regulatory role in convening, developing educational materials, identifying and addressing barriers to overcome, and making information and technology more visible and available. One recommendation would be for EPA to take the lead in bringing other stakeholders whose respective missions have in common the reduction of pollution from agricultural sources together so that their resources could be better aligned. This could lead to more efficient and effective use of resources as well as a reduction in duplication and conflicting messaging.

Example: ***AgStar***

AgStar is a positive example of EPA playing a leadership role in the promotion of a new technology. AgStar is a program focused on increased adoption of digester technology to capture greenhouse gases. EPA is leading by convening, facilitating, and developing educational materials. EPA's motivation is clear in this situation. The agency is contributing to trust by building an information exchange while validating a management practice and promoting increased adoption of a specific technology. AgStar demonstrates how EPA can play a role in bringing people together to learn about technology and how it can be adopted or integrated into practices and help increase uptake for larger impacts. Better understanding and advancing use of digesters is also an example of an issue that requires a partnership approach. Given the complexity of issues related to digesters, from science to technology transfer to use, and the diversity of entities involved, from engineers and other researchers to farmers to energy generation entities to air and climate stakeholders, making progress with digesters without a partnership bringing these entities to the table collectively would be very difficult.

b. EPA as one of the stakeholders

As a stakeholder, EPA can be a participant in the partnership on an equal basis with every other stakeholder. In this role, EPA should clearly communicate any regulations, parameters, or limitations on which there is no compromise so there is no misconception or false hope in an outcome that EPA cannot support. The partnership will trust and respect those limitations if they are communicated and explained adequately up front.

There are some activities that are and should remain the exclusive domain of EPA. For example, EPA should remain the enforcer of the regulatory backstop and make clear the implications of not being able to address environmental problems through the alternative pathway offered by the partnership. It is critical that everyone know when or under what circumstances EPA will assert itself so that the partners are not undercut.

***<u>Example:</u>* National Association of Counties (NAC)**

EPA is promoting the exchange of information. In this example, EPA is learning from counties how they are approaching issues at the local level. Counties are learning from EPA the national leadership perspective. This example demonstrates EPA's interest in learning—no formal agenda, just reaching out and engaging—promoting information exchanges and building relationships.

c. EPA as facilitator

In the role of facilitator, EPA can provide resources to foster the establishment, enhancement, and successful outcomes of partnerships. Examples of resources that EPA can contribute are financial, staffing, facilities, and informational materials, as well as subject matter expertise. In this role, EPA may or may not have a visible presence in the partnership. While their resources may be critical to the partnership, their presence may be a hindrance. There will be situations where other agencies and organizations, (local, state, and federal), have established relationships with agricultural producers and the most appropriate role for EPA is to facilitate, but not be an active participant. Another facilitative role the Agency can play is to assist with identification of mechanisms to be tapped to support a partnership (see below regarding mechanisms).

This report is a product of a partnership created and fostered by EPA. The Farm, Ranch, and Rural Communities Advisory Committee consists of a diverse group from industry, non-profit associations, and local agency representatives. Great care has been taken by EPA to introduce various differing perspectives and foster frank, open discussion without injecting its perspective or attempting to affect any particular outcome other than soliciting key recommendations from stakeholders so that the Agency can better achieve the outcome of reducing pollution from agriculture without unduly burdening farmers, industry, and the community.

3. Mechanisms essential for supporting partnerships

Mechanisms for forming and supporting partnerships are critical to their effective use in addressing water quality problems. Identification of potential mechanisms to be tapped by different communities shaped by different parameters or scope, are important to highlight in advancing partnership strategies. One mechanism to note is EPA's Community Action for a Renewed Environment (CARE) program.

4. Key types of partnerships

As a result of the Partnerships Work group's deliberations on a range of partnership examples – both positive and negative – they identified characteristics of situations where partnerships could be particularly effective. Four such situations are outlined below, followed by the Partnerships Workgroup specific recommendations to the Agency for establishing critically needed partnerships.

a. Partnerships to advance collaborative research to better understand the science behind challenges and opportunities, support collection of data from which to develop solutions, and present compelling arguments for the adoption of those solutions.

Problem:
Water quality and other natural resource challenges related to agricultural impacts are complex. This complexity stems from the diversity of agriculture itself – both between agricultural sectors and types of individual farming operations, as well as the vast diversity of landscape conditions and diversity of additional sources of nutrients and other potential impairments of water quality. Many situations require more and better scientific understanding in order to make good decisions and take action that will deliver meaningful improvement. Furthermore, there is a need for more advanced science to allow better understanding of a number of questions regarding agricultural impacts to water quality that remain controversial or poorly understood, and to develop agreed upon and effective strategies for making progress. These situations require investments in scientific advancement if we are to realize EPA's mission to improve the nation's water quality resources, a goal shared by agriculture as well. Inadequate understanding of the causes of or solutions to pollution from agriculture is a significant barrier to adopting beneficial behaviors or abandoning harmful behaviors. Overcoming these barriers involves not only technical solutions; social and economic sciences also have important roles to play in developing and implementing solutions sustained over the long term. EPA must leverage partnerships to bring these critical considerations fully to the table as well in order to develop and advance viable solutions.

Solution:
In situations where the science needed for making decisions and taking action is complex and/or controversial and requires the involvement of multiple stakeholders in order to achieve agreed-upon understanding and identification of solutions, EPA can and should play a beneficial role by bringing partnerships together. In fact, when questions and controversy stem from a deficit of good science, advancing partnerships to develop the needed science should be the standard approach to answering pressing questions and developing strategies. This strategy would be a more efficient, effective, and acceptable starting point for EPA as compared with the Agency moving forward with plans to address the problem or issue without collective understanding or agreement on the basic information - only to have their efforts challenged.

One example of EPA advancing a partnership to support research and improved data collection and analysis is the National Air Emissions Monitoring Study in which EPA worked cooperatively with industry, USDA, and universities. Although NAEMS was the result of a consent decree, the result was a partnership in which all parties are engaged and have a stake in the development of new information essential to helping implement solutions and solve the problem.

Implementation:
Before embarking on a science and research-focused partnership effort, EPA and involved stakeholders should consider a number of questions, including structure, key factors for success, EPA's role in the partnership, and how the results can be best used. In addition, mechanisms for establishing such partnerships should be identified in order to facilitate their establishment.

b. Partnerships to develop options for the resolution of an identified problem

Problem:
Water quality issues can be clearly understood from a technical dimension, but developing potential solutions that are effective and enduring can require multiple stakeholders working together. When a problem has been identified, a collaborative process can bring stakeholders together to generate solutions. The benefits of developing solutions together include establishing a collective understanding of the technical facts, more creative and diverse range of potential solutions, a commitment by a broad range of stakeholders to take action, and thus, a more comprehensive approach to solving the problem. An additional benefit can be de-escalation of conflict or controversy among stakeholders. However, if progress is not made in working together to solve the problem creating the controversy in the first place, the tension and conflict can return.

Solution:
Solutions-generating partnerships are most useful when there is significant scientific understanding of the issue or situation, but many questions remain about how best to develop and implement solutions. These partnerships focus on creating a means for open discussion about issues with the goal of generating agreement on new and effective solutions. Given that EPA's direct regulatory authority over non-point sources is limited, non-point water quality challenges are especially in need of partnerships to find and advance solutions. Given this reality, we believe EPA should seriously assess why partnerships are not a more central strategy for EPA in advancing solutions. We recommend that EPA assess a number of key issues that may be acting as roadblocks to better utilization of partnership approaches to bringing parties together to discuss and resolve differences. These issues may include whether EPA has adequate capacity (e.g., trained, dedicated professionals) and openness within relevant program areas to better prioritize collaboration and partnerships before regulatory approaches are considered.

Two examples of resolution-focused partnerships are the Rocky Mountain National Park Air Quality Initiative (RMNPAQI), created to facilitate timely development and implementation of air management policies and programs using a combination of voluntary and existing measures to reverse the trend of increasing nitrogen-related compound impacts affecting the park, and the Illinois River Watershed Partnership, formed to discuss non-regulatory and non-litigation solutions to water quality in the Illinois River Basin where there was a long history of litigation over water quality in the Illinois River.

Implementation:
Before embarking on a partnership aimed at resolving a difficult issue, EPA must consider a number of issues, including how to bring the needed stakeholders to the table in a collaborative fashion, something that could take time and careful planning. It is important that stakeholders come to the partnership as interested collaborators if at all possible, and not as reluctant or required participants. In addition, EPA should consider what resources will be needed to access data and sources of expertise to bring science-based information to the discussion and to develop pilot projects or initiatives that can foster finding common ground. EPA should also consider what timeframe is appropriate and be prepared to remain engaged for the duration of the effort.

c. Partnerships to implement solutions

Problem:
In some situations involving water quality problems linked to agricultural production, the technical issues have been identified and characterized, and solutions have been developed, but those solutions require action by more than one entity or small number of stakeholders, and would be much more effectively deployed with the cooperation and collaboration of multiple entities. In such situations, including those discussed above, where partnerships are formed to jointly understand and characterize the science and technical nature of the environmental problem and develop possible solutions, strategic formation of partnerships can be critical to effective implementation of plans to remedy the problem.

Solution:
The third kind of partnership we recommend EPA prioritize within its work to address non-point source pollution are those focused on implementing solutions. These implementation-focused collaborations are the most familiar scenario, with many examples of EPA supporting or participating in implementation partnerships. Examples of partnerships focused on implementing strategies and projects to address water quality challenges within agriculture include the Waste Solutions Forum in the Shenandoah Valley of Virginia, created to bring partners together to find economically viable solutions to water quality challenges linked to animal agriculture and excess manure, the Upper Chester River Watershed initiative in Maryland, and many others.

Implementation:
In further supporting and advancing implementation-focused partnerships, some key questions for EPA to consider include: 1) whether the Agency has adequate understanding of the problem from a technical and solutions perspective in order to organize and support truly effective partnerships, and 2) how the agency can more fully develop adequate capacity to engage more fully and effectively in these efforts. Additionally, mechanisms enabling forming such a partnership should be identified in order to facilitate their establishment. One such mechanism is the EPA's Community Action for a Renewed Environment (CARE) program (http://www.epa.gov/care), which provides grants through a competitive process to establish partnerships for reducing pollutants in the environment. Grants are provided to form partnerships to implement solutions.

d. Partnerships for fostering improved understanding, information exchange, and building trust

Problem:
There is a lack of basic understanding, familiarity, and established trust between the Environmental Protection Agency and the agricultural community. Many producers and producer organizations are familiar with government agencies and programs, but primarily with agricultural extension agents, Natural Resource Conservation Service employees, and other agricultural-focused entities. And typically, these relationships are focused more on support and assistance, rather than regulation and enforcement. EPA's culture is more versed in regulating point-source stakeholders, and therefore industrial entities. Consequently, there is less familiarity among different stakeholders and relationships are less established. As a result, the potential for miscommunications and tension is much higher. The Partnerships Workgroup encourages EPA

to value putting time and effort into developing deeper understanding of the agricultural production community, to provide opportunities for the agricultural community to understand how EPA conducts its business, and to demonstrate its interest in working collaboratively.

Another successful model, despite the fact that it was recently discontinued by EPA, was the Strategic Agricultural Initiative. The SAI sent funds to the EPA regional offices to encourage the use of Integrated Pest Management to help specialty crop growers adjust to the Food Quality Protection Act. The funds helped support the agricultural coordinator in each region, facilitated networking on the part of the coordinator, and created a small grants program in each region, used strategically to address critical IPM needs by growers in their region. The program helped generate good will between producers and EPA because it was proactive, established and advanced dialogue between EPA staff and growers, and helped producers adjust to the loss of key pesticides by offering alternative practices promoting profitability.

Solution:
In order to create better working partnerships, the EPA Regional Administrators should clarify and elevate the roles and responsibilities of the Regional Agricultural Advisors. The goals and responsibilities of these EPA leaders on agriculture issues around the country are little understood by stakeholders in the agricultural community, meaning key opportunities to leverage these staff to build trust are being missed. While these regional advisors have and continue to do very good work, they are under-resourced and under-staffed to achieve the important impact they could have in developing and advancing partnerships to implement solutions and build trust and understanding between EPA and agricultural stakeholders.

EPA also should advance cross-talk and collaboration among the Regional Agricultural Advisors and involved stakeholders in a transparent way. Such collaboration could create a common baseline for stewardship, and help to head off uneven economic conditions or an uneven playing field that can result in unintended or undesireable outcomes. For example, the past decade has seen a migration of dairies from areas of high regulation to areas of relatively lower regulations. Coordination and a common framework would better serve the industry, public, and the environment by preventing great variability in expectations.

Implementation:
In order to create better working partnerships, the EPA Regional Administrators should establish the following as priority responsibilities of the Regional Agricultural Advisors and provide increased resources/support to achieve these ends: 1) Hold quarterly/regularly scheduled meetings with agricultural partners to provide information on agriculturally related activities by EPA in the region and nationally and to receive feedback (with Regional Administrator); 2) Work with regional partners to identify the top three agricultural resource conservation issues in the region and facilitate partnership approaches to develop and implement solutions to those issues; 3) Dedicate time to meeting and interacting with agricultural producers and stakeholders around their region on an on-going basis; and 4) Create much improved tools for communicating the activities of the Regional Agricultural Advisors, including easily-findable areas on the EPA website for the Agricultural Advisors, their meetings, and partnership efforts to address pressing issues and newsletter/email communications to provide important updates, share information about EPA and partner activities, and help foster improved understanding.

Aligning the roles, priorities, and profile of the Regional Agricultural Advisors in this way would allow for and acknowledge the substantial differences in various agricultural regions of the country and the need for different approaches, while more systematically demonstrating EPA's interest in and commitment to working with the agricultural community in addressing regional challenges and fostering improved communications and, ideally, trust.

IV. Recommendations

Partnerships can be powerful in understanding the challenges and opportunities surrounding improved water quality, developing solutions, and implementing those solutions. Based on the Partnerships Workgroup members' research and deliberations, ideas for recommendations focused on four phases of addressing agriculturally-related water quality problems, including: identification of, and gathering pertinent information for, development of a shared understanding of the problem at the scientific and technical levels; generation of solutions to address the water quality problem; implementation of solutions to address a water quality problem; and building overall understanding, cooperation, and trust.

One way EPA could increase resources for developing, facilitating, and supporting partnerships is through 319 program funding. EPA should evaluate how 319 funds are being used currently and how some of these funds could be redirected and dedicated to advancing partnership approaches. EPA also should evaluate how EPA science programs, research initiatives, and grant funding can be leveraged to advance partnership approaches to developing better understanding and consensus around pressing water quality issues.

Although there is a huge diversity of initiatives worthy and in need of EPA support, the FRRCC Partnership Workgroup recommends that EPA advance and provide support for the following partnership efforts that we believe represent some of the most pressing challenges and hurdles to making real progress on water quality related to agriculture, in which EPA could play a valuable role by creating partnerships to advance answers and solutions.

Methodologies and tools for measuring and documenting impact: Today, we do not have commonly agreed upon methods, protocols, and metrics for measuring agricultural conservation efforts, or cost-effective and user-friendly tools for collecting measurement and documentation data. This creates a real challenge for effectively evaluating and documenting progress and areas in need of improvement and for advancing a wide variety of approaches that can deliver meaningful improvements in water quality – voluntary and regulatory. For many, market opportunities to bring more private sector capital to the table to advance agricultural conservation efforts and enable farmers to access markets are of great interest. Without agreed-upon, reliable, and scientifically-sound tools and protocols for measuring and documenting impact, such markets will continue to struggle. Regulatory drivers help to create markets for producers, such as nutrient credit trading, and especially for point-nonpoint trading, but such credit markets are not the only marketplace opportunities. Supply-chain sustainability initiatives are also in development, as well as interest in securing clean water for industries dependant on clean water for processing (such as beverage or pharmaceutical companies) and proactive drinking water utilities. For all of these opportunities, the ability to measure and document change is equally important.

***Recommendation**:* EPA should to work with USDA to convene, facilitate, and provide resources for a multi-entity, multi-disciplinary partnership to develop and advance collective support for a set of tools, protocols, and metrics for measuring, documenting, and verifying water quality benefits from agriculture. EPA could play a leadership role, or strongly support expanded efforts by USDA's Office of Environmental Markets. The development of these tools and metrics would support market development as well as improving the benefit and outcome of regulatory strategies. Without these cost-effective, user-friendly, and scientifically-sound tools, protocols, and metrics, markets will never succeed and farmers will not be able to take advantage of the opportunities they present. This science and research-focused partnership should include non-traditional disciplines, such as engineering and robotics departments (such as the work on sensors by engineers at Carnegie Mellon University) in order to stimulate innovative thinking about how to develop cost-effective tools for measuring impact.

Possible next steps could include:

- Survey and assess current science on measurement and documentation.
- Identify scientific entities (public and private) involved in development or refinement of measurement tool and methodologies and their current scope of work/areas of interest.
- Hold summit to bring together key potential partners, including researchers, funders, organizations, and agencies to develop framework for partnership on advancing the science and tools for measurement.
- Develop and coordinate joint initiative going forward to implement action plan on research, testing, and use of improved tools and methodologies for measurement and documentation.
- Play a lead role in developing the modeling and monitoring needed to further advance the science of measurement .
- Connect to ecosystem services/ecosystem markets programs with EPA and USDA.
- Signal EPA support for various measurement tools and methodologies by publishing guidelines that lay out acceptable standards.

Conservation Practice Improvements: As documented in the CEAP reports for the Upper Mississippi River Basin, Chesapeake Bay, and the Great Lakes, farmers have made good progress in reducing sediment, nutrient, and pesticide losses from farm fields through conservation practice adoption. But there is much still to be done, especially in terms of moving beyond basic nutrient management and other critical conservation practices and helping farmers evaluate and fine tune practices to their own operational conditions. Unfortunately, today's one-size-fits-all approach to nutrient management and many other conservation practices does not provide farmers with the tools or feedback loop of information to evaluate their practices and fine tune their efforts for enhancing and improving efficiency and impact. We must find and advance ways to continue and accelerate improvements in nutrient management, and do so in ways that are economically viable and won't compromise yields.

Recommendation: EPA should convene, support, and facilitate a multi-entity, multi-disciplinary partnership to evaluate and advance more effective approaches to delivering real improvements to nutrient management and other critical conservation practice efforts, and to advance more effective use of federal and state resources invested in conservation programs. Specifically, the

Assistant Administrator of EPA's Office of Water should support and enable a multi-entity, multi-disciplinary partnership to evaluate and advance real improvements to developing and delivering best management practices (all conservation or nutrient management/capturing conservation practices – CEAP priorities) and to advance more effective use of federal and state resources invested in developing best management practices. This partnership, which should be an EPA-USDA joint initiative, should be dedicated to advancing data-driven adaptive management of nutrients and soil health that will enable famers to fine tune generalized recommendations for their specific situation/operation and make cost-effective decisions that reduce nutrient runoff and loss while protecting yield and profit. This partnership should advance extensive data gathering through a network of partners and farmers conducting on-farm evaluations of nutrient management practices. Through this extensive data gathering and analysis, the partnership would generate the data and analysis needed to benchmark different conservation measures and approaches at the local and regional level, providing farmers with a meaningful way to evaluate and document the impact – environmental and economic – of their nutrient management plans and practices. This partnership would also dive into discussing and advancing agreement around protocols and tools for collecting and analyzing data, tools for evaluating nutrient use efficiency or the effectiveness of other conservation practices, and strategies for effective farmer and partner engagement and understanding to deliver sustainable change. The partnership should evaluate and help advance further development of a broad range of tools, including incentives that could address possible reduction in yields, and therefore profit, as a result of pro-active nutrient management. Such incentives could include insurance clauses promoting lower nutrient levels, nutrient trading schemes encouraging reduced fertilizer applications, and setting aside vulnerable lands.

Possible next steps to launch a Joint USDA-EPA Initiative:

- Survey and assess latest science on nutrient management, focused on N and P.
- Organize and hold a summit on nutrient management science and tools.
- Create a joint task force to develop partnership with universities.
- Develop partnership research plan for filling research, data collection, and analysis needs and developing agreed upon protocols on data collection, management, and analysis.
- Create a new multi-university center for nutrient management supported by EPA, USDA, and partner funding.
- Develop monitoring protocols and initiatives.
- Use findings to inform level of stewardship expected in certainty agreements.

In addition, the Assistant Administrator of EPA's Office of Water should leverage this partnership to advance more effective use of federal and state resources invested in developing best management practices:

- Dedicate a portion of 319 resources to build watershed-level capacity to develop plans and projects addressing water quality.
- Develop partnerships with states for the implementation of state nutrient management plans.
- Develop and provide funding for active outreach strategies to disseminate information and lessons learned from 319 and other watershed projects, including a requirement or prioritization for such an outreach strategy for getting ideas out to partners and agencies as a component of grant funding.

- Establish prizes to incentivize development of improvements to existing conservation practices and development of innovative practices and technologies. EPA should prioritize within this effort improved effectiveness of nutrient management, improved documentation of cover crop effectiveness, and more optimal and effective placement of filtering practices.

Improve support for and visibility of the role of Regional Agricultural Advisors: Building greater trust and collaboration between EPA and agricultural stakeholders requires that EPA make a priority of building relationships on the home turf of those agricultural stakeholders. In order to create better working partnerships, the EPA Regional Administrators should clarify and elevate the roles and responsibilities of the Regional Agricultural Advisors. The goals and responsibilities of these EPA leaders on agriculture issues around the country are little understood by stakeholders in the agricultural community, meaning key opportunities to leverage these staff to build trust are being missed. While these regional advisors have and continue to do very good work, they are under-resourced and under-staffed to achieve the important impact they could have in developing and advancing partnerships to implement solutions and build trust and understanding between EPA and agricultural stakeholders.

Recommendation: EPA Regional Administrators should establish the following as priority responsibilities of the Regional Agricultural Advisors and provide increased resources/support to:

- Increase and better coordinate communications with regional agricultural partners on relevant EPA activities and dedicate time for meeting and interacting with producers and stakeholders in the field on an on-going basis.
- Collaborate with regional partners to identify the top three agricultural resource conservation issues in the region and facilitate partnership approaches to develop and implement solutions to those issues.
- Create and support much improved tools for communicating the activities of the Regional Agricultural Advisors, including user-friendly online information and web pages.

III. RESOURCES WORKGROUP REPORT

FRRCC RESOURCES WORKGROUP REPORT

INTRODUCTION

Crop and pasture land are dominant land uses in the U.S. These lands prolifically produce food, fiber, and energy for the world but are interwoven with a natural fabric of rivers, streams, creeks, lakes, and an artificial network of ditches, tiles, and reservoirs. It is easy to see how the choices made daily by a multitude of agricultural producers in selecting and managing production practices can potentially impact water quality. However, casting blame upon them exclusively for deteriorating conditions inhibits the communication and cooperation necessary to take unified actions to improve water quality.

Like everyone in our society, farmers and ranchers value clean water. This Committee believes the most effective way to use limited resources is to support agricultural producers technically, socially, and financially. This can help them successfully and sustainably minimize adverse environmental impacts. The continued funding of programs and activities of assistance by federal agencies like EPA and USDA for agricultural producers demonstrates public support for this concept.

The FRRCC Resource Subcommittee was tasked to: 1) Consider the resources necessary to help agricultural producers address water quality problems related to the runoff of nutrients from their farming operations; and 2) Provide recommendations to EPA on how to more effectively allocate and manage its resources to address this challenge.

To address nutrient pollution from agriculture, we must expand the dearly held value of farmers and ranchers for their land to include the ecosystem of which it is an integral part. With a broader vision, knowledge, and resources, farmers and ranchers will, in greater numbers, make management decisions and adopt and sustain behaviors that will result in reduced pollutant loads to surface and ground waters. To achieve this shift, the group considered the types of resources needed (financial, technical, and educational), who needed them (producers, students, regulators) and at what level they were needed (state, community, farm). The group then considered how the Agency could most effectively leverage its resources and influence the allocation of resources by others to accomplish the goal of improving water quality.

SUMMARY OF RESOURCE WORKGROUP DELIBERATIONS

The FRRCC Resource workgroup characterized the challenge of addressing NPS pollution from agriculture as one of focusing on the values and behaviors of farmers and ranchers and removing the barriers to adopting, continuing, and sustaining beneficial behavior. For example, one barrier is the perception that the science used to develop the recommendation may be questionable. Individual producers, as well as the local suppliers of production inputs, need to be aware of the problem and feel they have a personal, important role in its resolution. They need to know that those who are developing solutions understand both water quality and agricultural production. They need to know what kind of solutions they can adopt and be confident they will work. They need evidence-based information that indicates that solutions will not impact the financial viability of their farming operations in the long term. In many cases, they will need additional resources to implement effective solutions. The methods and tools to create this change include education and information sharing, incentives, technical assistance, financial assistance, regulation, and peer or community pressure (negative) or recognition (positive).

Local, state, and federal budgets are facing significant cuts so many of the funds that traditionally have helped farmers and ranchers implement conservation practices may no longer be available. As a result, EPA and its partners will need to better target their resources to sources that contribute disproportionately to water quality problems and act proactively in watersheds to avoid future costly litigation.

Ultimately, the group agreed that one of the most promising approaches for EPA may be to shift its focus from permits and the attendant planning requirements to establishing a reasonable level of stewardship for farmers, recognizing the conditions under which normal agricultural practices require they operate. Achieving this level of stewardship would in essence comply with the Clean Water Act and protect producers from having to achieve any further reductions in pollutants during the period for which the certainty applied. EPA would need to coordinate with state and local regulators to reach agreement that achieving this level of stewardship was also sufficient to secure regulatory relief from state and local ordinances. This reasonable level of stewardship would include: 1) variances for those whose site-specific, extraordinary circumstances make the standard an unreasonable or inapposite expectation; 2) incentives for those who can and will perform above the level of stewardship (e.g. access to environmental services markets); 3) access to financial cost-share assistance and time to achieve the level of stewardship (e.g. working with USDA to align USDA cost-share programs to help producers achieve the accepted level of stewardship); and 4) consequences if the accepted level of stewardship is not attained.

INSIGHTS/KEY ISSUES

Adequate resources (people, money, and time) are required to provide technical, educational, and financial assistance to effect and sustain positive change. For people, we singled out the importance of trusted local individuals who are available for the “long haul” in sufficient numbers to reach key stakeholders with the technical and social skills to effectively communicate, educate, perform, and persuade. For money, resources are needed to develop and implement targeted programs at every scale (national, regional, state, local, farm), and to start and sustain local initiatives. For time, we looked at what could be done immediately, in the near future and over the long term. For example, EPA has the exclusive authority over and can focus its Section 319 grants. It could use these funds more effectively as a near term action.

Over the intermediate term, we saw potential synergy between EPA and USDA. The two agencies have important goals in common. While it would be more efficient and effective for them to align some of their programs, we recognized that was a politically sensitive issue. EPA is not now in the position to advocate strongly for changes in the farm bill to accomplish this. However, it can continue to develop its evolving partnership with USDA.

In the longer term, promoting the use of water quality trading to provide NPDES permit holders more flexibility in responding to more stringent regulations could provide additional dollars for producers to reduce nutrient run-off. All parties need to recognize that it will take time to develop effective programs and plans at all levels and that activities have differing physical, environmental, social, and financial limitations beyond the control of agricultural producers. It will take years and maybe decades before agricultural producers and society as a whole universally adopt the desired values and behaviors and legacy pollutants work their way out of the system.

RECOMMENDATIONS: People, Funds, and Processes

EPA should ensure it has adequate staff and funding to implement FRRCC recommendations if it is to undertake remediating pollution from agricultural sources.

We recognize that the federal budget is shrinking. This is why our recommendations focus on how to make the most efficient and productive use of resources allocated to remediate nutrient pollution from agricultural sources. This goal should not be undertaken lightly. If it is truly a priority, there must be adequate resources allocated to achieve success. At the most fundamental level, this requires qualified people, who are detailed exclusively and funded adequately to develop, implement, and adaptively manage this program. The Regional Agricultural Advisors and Strategic Agricultural Initiative Specialists are positions which are most suited to advancing many of the specific recommendations of the FRRCC Resources Subcommittee that are described below.

EPA Administration should create and maintain full-time Regional Agricultural Advisors in all 10 EPA Regions who report directly to the Regional Administrator. This action would elevate the prominence of agricultural issues and demonstrate that EPA has a dedicated commitment to communicating and working effectively with agriculture on environmental issues. All regions have agriculture as a major land use that contributes significantly to nutrient pollution. To create a fair and level playing field for agricultural producers, all regions must make commensurate contributions to improvement. This cannot happen without an agricultural advisor dedicated exclusively for this purpose. The corollary is that this person must be carefully selected for a specific skill set. They must know agriculture and work well with farmers and ranchers. They must be technically proficient to understand the problems and potential solutions. They must also be able to work collaboratively and productively with all stakeholders.

EPA Administration should establish a Strategic Agricultural Initiative (SAI) Specialist program using the previous IPM SAI model to focus on reducing agricultural water quality impacts. This action will provide additional focus on the effective technology transfer to agricultural producers. Originally, EPA designated one SAI Specialist for each of the ten EPA Regions to act as a catalyst to develop partnerships with agricultural stakeholders such as growers, farmers, educators, USDA, and universities to assist in transitioning away from certain pesticides, and provided a small grants program for strategic investments. EPA should re-establish the SAI program and expand the focus of the SAI specialists to include reducing nutrient and sediment loads leaving agricultural lands.

EPA should expand its support of the EPA-Land Grant University (LGU) Liaison positions in all regions. EPA should work with the LGUs to provide salary and adequate travel budget for an adequate number of LGU Liaisons to work with each state within their region and enhance communication and cooperation between EPA and the LGU system. These liaisons will allow EPA to connect more effectively with the LGU systems at the state and local level. These positions are funded jointly by EPA and the LGU system and could be focused on better aligning resources at the federal agency level with actions at the field level.

EPA should make a planned effort to work proactively with the agricultural community on water quality issues.

EPA should apply resources to being proactive. EPA should engage with watershed residents early on before planning any regulatory action to encourage local action, discuss possible solutions with agriculture, and, where appropriate, convene state agencies, funders, USDA Natural Resources Conservation Services (NRCS) District Conservationists, LGU Extension agents, and commodity groups to better align resources to address the problem. This may help EPA avoid some lawsuits and their resulting costs by reducing problems before they lead to litigation.

- Use easily understood "messages" for the intended audiences, uniform and consistent across the Regions and within a Region, and timely so that the audience has an adequate opportunity to receive, understand, and act.
- Deliver the messages in a forum that is likely to reach the intended audience (e.g. agricultural stakeholder's coffee).

EPA and State regulatory agencies should develop and support integrated training for their employees and other stakeholders on agricultural production practices so that they may be more effective in working with farmers. This will result in a greater understanding of the application and limitations of current agricultural best management practices by EPA and state regulatory personnel.

EPA should encourage and support state certainty programs.

Work with States to establish a reasonable level of stewardship for certainty agreements. EPA should help states shift the focus from permits and the attendant planning requirements to establishing a reasonable level of stewardship for farmers, recognizing the circumstances under which they typically operate. This approach will allow EPA to meet the overarching goal of achieving clean water with less conflict and while using fewer resources. Achieving this level of stewardship would then exempt participating producers from future regulations. EPA and USDA are currently pursuing a certainty program in the Chesapeake Bay Watershed that provides certainty to farmers who implement an agreed-upon set of practices to protect water quality. In this case, the federal agencies are exploring a constructive framework that the Bay States can use to provide producers incentives and recognition that accelerate the adoption of conservation practices and advance the objectives of the State Watershed Implementation Plans.

- Work with USDA-NRCS, industry, Land Grant Universities, State regulators, Conservation Districts, Professional Agronomists/Soil Scientists/Agricultural and Biosystems Engineers/Animal Scientists, and Tribal and Environmental representatives to establish a framework that States can use to establish "reasonable level of stewardship." This framework would identify science-based practices and management methods that result in a higher standard of stewardship and include: 1) variances for those whose site-specific extraordinary circumstances make the accepted level of stewardship an unreasonable or inapposite expectation; 2) incentives for those who can and will perform above the accepted stewardship level; 3) access to financial cost-share assistance and time to achieve the standard of stewardship; and 4) consequences if the accepted stewardship level is not attained.

- Work with States to develop recommended uniform checklists that assess a farm's operation and management against this reasonable level of stewardship. See, for example, the *Environmental Farm Plan Reference Guide* developed by the BC Ministry of Agriculture to assist farm producers in developing an environmental action plan for their farm. The purpose of the plan is to enhance natural resources and reduce the possibility of accidental harm to soil, air, water, and biodiversity values.

- Work with States to provide a fast, fair mechanism of enforcement. Also, EPA must coordinate with state and local regulators to reach agreement that once farmers achieve the agreed-upon level of stewardship, they have done enough to secure regulatory relief from state and local ordinances. [e.g. when EPA negotiates with States for the delegation of CWA authority, it can exact a reciprocal commitment by the State to honor certainty agreements.]

<u>Consider how best to incorporate the "reasonable level of stewardship" into the TMDL process</u>. Establishing TMDLs with their DIPS (Detailed Implementation Plans) are enormously resource-intensive. They consume a huge amount of time as well as financial and human resources. Protracted battles are waged over appropriate numeric nutrient criteria and load allocations even though we already know that agricultural activities have potential impacts and understand most of the practices we need to implement to remediate them.

- Review existing TMDLs in watersheds where agriculture is a significant land use. Identify the activities that generate pollution and determine which have the lower cost/benefit rating. Consider the awareness, economic feasibility, and technical capability of the farmer before making recommendations.

- Achieve a reasonable level of stewardship by offering certainty agreements to farmers who implement the agreed-upon set of practices. Conduct TMDLs only after a standard of stewardship has been uniformly adopted but the level of pollutants in the watershed remains at an unacceptable level.

<u>RECOMMENDATIONS: Leveraging Resources with Others</u>

Improve effectiveness of currently available resources.

The following recommendations consider ways in which EPA can improve the effectiveness of current resources by allocating or applying them differently.

<u>Use Nonpoint Source Program Clean Water Act Section 319 and Clean Water State Revolving Funds (SRF) funds more effectively</u>.
Two sources of funding from EPA will be critical to the success of any agricultural nutrient remediation program. The 319 funds and SRF funds are used, respectively, as grants to non-point source projects and loans for environmental projects. Due to the magnitude of the challenge and limitations in other funding sources, more expansive and creative uses of these funding authorities should be brought to bear on this problem.

In some states, the opportunistic distribution of these funds through grant application programs for "pilot projects" has proved to be ineffective in curbing deterioration of water quality. While the individual pilots may have been successful, funds were not available to extend the successes to other watershed nor to sustain the effort. However, there have been marked improvements where 319 funds have been used for large-scale programs. For example, the *303(d) Watershed Planning and Assistance Project* conducted in South Dakota from 2003 through 2010 was funded in part with 319 funds and matched by USDA NRCS program funds. The resulting design and implementation of BMPs reduce nutrient and sediment run-off from 146 animal feeding operations, 10,000 acres of cropland, nearly 175,000 acres of pastures and grazing lands, and nearly 371,000 feet of restored, protected, or stabilized riparian areas and stream bank. The calculated reductions in nitrogen, phosphorus, and sediment prevented from reaching 303(d)-listed waters in South Dakota by the BMPs installed totaled 1,979,420 pounds, 465,786 pounds, and 114,440 tons respectively.

Recommendations to increase the effectiveness of 319 funds include:

- Use 319 funds to complement those from other Federal and State agencies used to conduct large-scale collaborative efforts to remediate nutrient pollution from agriculture.

- Make 319 funds more accessible to groups that will use these funds to better define an appropriate level of stewardship by removing or significantly reducing the 40 percent cost-share requirement. For example, the match required for participation in USDA's EQIP program is 25% generally and as little as10% for historically underserved producers. EPA may be able to encourage states to make matches more flexible within grants to achieve the ultimate state level match of 40%.

- Leaders of the EPA 319 Program should work with USDA National Institute for Food and Agriculture program leaders to coordinate water quality funding opportunities such that 319 funds can be used to leverage NIFA funds to meet objectives shared by both programs in a focused manner that results in greater impacts.

- Use 319 funds to help States develop reasonable levels of stewardship for certainty agreements. Describe the minimum elements of a "stewardship" program (the federal framework) and target the programs geographically (where agriculture contributes significant nutrient loads); politically (where stakeholders are willing to support the development and implementation of the program); technically (where there is a cadre of scientists, educators, and agricultural professionals who can and are willing to help farmers); and comprehensively (where there is an alignment of resources by other agencies and governmental units at the local, state, and federal levels).

- Use 319 funds to monitor the effects of investments and adaptively manage the allocation of resources.

SRF funds have been traditionally used to build and improve wastewater treatment plants. Eligible activities have been expanded to include: projects to control runoff from agricultural land; conservation tillage and other projects to address soil erosion; development of stream bank buffer zones; and wetlands protection and restoration. We recommend further expanding their use to help create environmental services marketplaces that could bring new and self-sustaining incentives for producers to engage in voluntary actions to reduce nutrient pollution.

- Make SRF funds available to strategically establish wetland mitigation banks on farmland to effectively recruit and sequester nutrients, sediment, and pathogens. Proceeds from the sale of credits to developers in the watershed could be used to reimburse the SRF loan for the costs of creating the wetland, purchase development rights on farmland (to forestall the continued erosion and loss of the agricultural land base), provide strong, market-based incentives to farmers to contribute farmland to the wetland mitigation bank, and capitalize the creation of additional wetland mitigation banks.

Target to achieve greater benefit.

The following recommendations focus on targeting through cooperative approaches and leveraging to increase outcomes.

<u>Make a planned effort to connect more effectively with the agricultural community at the local level</u>.

- Connect more effectively with the LGU systems at the local level. Work to establish relationships and open communication with NRCS District Conservationists, Conservation Districts, and the LGU County Extension Agents.

- Cultivate relationships with the farming community. Working with farm groups and others, EPA could establish a regional/national agricultural environmental stewardship award program. This would accentuate the positive work being done on many farms today.

- Work with agricultural industry professionals (e.g. Technical Service Providers (TSP), Consulting Engineers (CE), and Certified Crop Advisors (CCA)). Through partners, EPA could help raise their general awareness of the impacts of agricultural activities to the environment and help them better understand the specific legal requirements regarding their behavior and their client's behavior (e.g. through the delivery of short courses offered by LGUs or as part of TSP, CE, or CCA training).

- Work with State regulators to better coordinate between state and federal regulations and resolve conflicting ordinances, better appreciate the practical and financial limitations within which farmers and producers operate, and enhance their customer service skills.

- Work more cooperatively with Land Grant Universities and community colleges. Through EPA's Environmental Education program, invest in developing a curriculum with these partners that addresses regulatory issues on the agricultural landscape for agriculture and natural resource students who are likely to be our future farmers and regulators. Post it for general use as society could benefit from this as well. Colleges could help prepare students to fill the jobs created by watershed-level protection and remediation programs by offering degree options focused on environmental science and related topics that provide a science-based curriculum focused on practical water quality issues.

- Working with farmers and ranchers through partnerships with LGU County Extension and others, EPA could provide more user-friendly materials that help raise awareness of: 1) the potential negative impacts that agricultural activities may have on future crop yields and ability to adapt to more severe weather events; 2) specific legal requirements and the solutions or resources available to avoid the negative impacts; 3) cross media benefits that may be achieved by implementing some conservation practices; and 4) the positive relationship between sustainability and profitability.

- Communicate with Agricultural industries (including retailers). They can support and reinforce producer behavior that improves water quality. EPA could recognize their efforts through a low cost "recognition/awards" program modeled loosely after the Energy Star program, for example.

<u>Strategically allocate resources by investing in actions that deliver the highest returns</u>.

- Take advantage of current, relevant reports and studies regarding the problem of nutrient pollution from agriculture, and its potential solutions. For example, the *Integrated Assessment on Hypoxia in the Gulf of Mexico*, NOAA Coastal Ocean Program Decision Analysis Series No. 20, selected principal investigators through an extensive peer review process. Topic 6 (*Evaluation of the Economic Costs and Benefits of Methods for Reducing Nutrient Loads to the Gulf of Mexico*) is particularly germane to targeting. It analyzes the relative cost-effectiveness of different control measures and potential benefits within the Mississippi River Basin for major nonpoint sources and identifies those with undesirable secondary effects. Topic 5 considers producers' ability to achieve nitrogen reduction using feasible production practices.
- From reviews of the literature and working with NRCS and LGUs, determine suites of conservation practices that are most effective and affordable and target education and technical assistance regarding these practices to those landowners with critically undertreated acres. These should be basic practices that help these landowners eventually reach the reasonable level of stewardship for certainty agreements.
- Demonstrate the importance of this initiative by marshaling Agency resources commensurate with the challenge. EPA will most likely need to deepen and expand its partnerships to garner what is necessary.

Improve coordination of resources.

The following recommendations improve the coordination of resources between programs and agencies and increase leverage.

- <u>Leverage private foundations</u>. Reach out to private foundations to discuss the impacts of unresolved water quality problems on the sustainability of our food and agriculture system, as well as ways to more effectively align private sector resources with Agency efforts. For example, seek informational meetings with AGree, a consortium of the largest private foundations capable of funding ambitious, multi-year, comprehensive policy reform efforts.

The AGree mission is to "support efforts that better enable U.S. policies related to food and agriculture to meet the needs for food, nutrition, environmental quality, and rural development within the U.S. and abroad."

- Leverage private sector efforts to establish performance metrics for agriculture. Increasing numbers of companies are publishing sustainability or corporate social responsibility reports. In 2009, 900 organizations published reports in the U.S. and all included a measure of water use while half included measures of water quality. Several commodity groups have undertaken their own measurement initiatives and several nonprofits have developed standards and metrics to differentiate products in the marketplace.
- Cultivate relationships with potential educators. Potential educators include Land Grant Universities; nongovernmental organizations (particularly producer and commodity associations), agricultural industry, conservation districts, watershed groups, state regulatory agencies, farmers/producer mentors (by reaching out to various agricultural leadership programs such as the Farm Bureau Young Farmers and Ranchers Program, the Kentucky Leadership program and others), certified crop advisors, USDA Technical Service Providers, seed and chemical representatives, etc.

Encourage and support ecosystems services markets.

Continue support for emerging ecosystem services markets. Ecosystem services markets include water quality trading programs. Water quality trading is predicated on the premise that sources in a watershed face very different costs to control the same pollutant. Ideally, facilities facing higher costs could purchase load reductions from farmers. This assumes that they have something to sell. This would not be the case if the "reasonable standard of stewardship" is set at zero discharge. EPA has an integral role in developing a certainty program that sets the "reasonable standard of stewardship" which, in turn either creates or severely limits the potential for trading water quality benefits. Other areas where EPA can offer support to emerging markets include:

- Encourage states to consider offering credit purchasers lower retirement ratios as an incentive for early participation in pilot trades (recognizing that this incentive must align with the Clean Water Act).
- Encourage states to work with markets to reduce uncertainty ratios through use of computer models to account for uncertainties in nonpoint source BMP performance.
- Where regulatory drivers (e.g. numeric nutrient criteria, TMDLs, and/or water quality-based effluent limitations) are not in place, encourage states to offer early credit purchasers assurances that their voluntary efforts will be counted towards any further regulatory requirements, including reasonable assurance under TMDLs. For example, if appropriate, permitting authorities could authorize longer-term compliance schedules to those entities that participate in pilot trades, or first rights to bargained-for reductions in the future.

Observation:

- Better coordinate available resources. We know that there are a lot of stakeholders working on this issue. We do not know the nature and extent of the resources that are being applied to the issue. We suspect that there are both duplication and gaps in how the resources are used. We believe that EPA could take a leadership role in answering these questions. With this knowledge, the Agency it could perhaps influence, if not coordinate, Land Grant University educational programs, USDA programs, and non-profit efforts to achieve specific water quality goals in targeted watersheds.

IV. SCIENCE WORKGROUP REPORT

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INTRODUCTION

Science is a discovery process that investigates the technical and economic relationships between activities and outcomes. Relevant assumptions are made, data are collected, theories or hypotheses are tested, and analyses are conducted that lead to conclusions about the problem or question under evaluation. This process may include construction or use of models that, though exceedingly complex, in fact simplify the real world to make timely, resource-limited research possible. Challenges may be made regarding the assumptions, methods, models, data and other factors of the scientific research. We examine these issues as they relate to the development, implementation and evaluation of sound federal water quality policy.

The Science Workgroup was tasked with an evaluation of the science-based process of discovery with regard to water quality policies. Specifically, the Workgroup was asked 1) to identify key areas of influence within the science-based process and 2) to make recommendations to EPA on how to better inform the policy development process with science-based information.

SUMMARY

The Science Workgroup separated our charge into three functional areas: models and standards, economics and communication. The *models and standards* focus aimed to assess: 1) how nutrient and suspended and bedded sediments (SABS[2]) criteria and standards are being established, 2) model uncertainties and the role of modeling in this process and 3) the links of models and standards to biological impacts on water quality and management solutions. In discussions with EPA scientists and policymakers, state regulators, academic experts and the affected farming community, we sensed a lack of transparency or understanding of the science used to inform water quality policy. This lack of understanding/information may exist in the:

- connection between the desired biological condition (water quality goals) and the criteria and standards set to achieve those goals.
- representation of Best Management Practices (BMPs) in models and documentation of BMP efficacy in meeting water quality goals.
- feasibility of improved linkages across models to better characterize a region on a water quality issue.

In some cases, the problem is one of perception. The science may be appropriate and the best available, but may be perceived by some groups as inadequate. The intersection of science and policy creates an additional set of problematic issues. Where science has an established record of success in defining "what is", scientists and policymakers are more challenged to determine "what ought to be or should be". The former uses facts as a basis, while the latter considers facts through the lens of judgment or opinion with policy goals sometimes guiding the process. That is the realm of the democratic deliberative process. Thus, science provides the foundation for informed, knowledgeable decision making. EPA recognizes that nutrient and SABS management is multi-faceted and complex and that these potential stressors come from a variety

[2] SABS are defined as organic and inorganic particles that are suspended in, are carried by, or accumulate in water bodies. This definition includes the frequently used terms *clean sediment*, *suspended sediment*, *total suspended solids*, *turbidity*, *bedload*, *fines*, *deposits*, or, in common terms, soils or *eroded materials*. (EPA Framework for Developing SABS Water Quality Criteria 2006)

of sources. However, while EPA targets agriculture for some aspects of the problem, it is important to remember there are other agents that bear attention and responsibility.

The *economic analysis* focus sought to address data, scope and methodological considerations in analyses as well as timing, team building and collaborations relating to the economics of policy development and policy implementation. The development, implementation and evaluation of environmental policies results in sets of economic costs and benefits that accrue to the land, targeted producers and society. It is not clear that these values have been fully determined or widely disseminated. Even where economic information has been collected, sharing of economic data may be restricted for legal reasons (e.g., confidential business information), participatory barriers (e.g., no record of BMP adopters who do not participate in conservation programs) or lack of a sharing mechanism (e.g., not knowing information is available). Even when conducted, economic analyses can vary in methodology which can lead to differences in results and thus recommendations. Tangentially, the economic constraints of government budgets, macroeconomic fluctuations, and ability of the market to respond to changes are factors that have real impacts, even if sometimes poorly understood. Economic analysis typically is based on the assumption that the institutional constructs of the world around us remain the same. The possibility that longstanding budgeted monitoring programs may be eliminated or scaled back may not be a part of the analysis, for example.

The c*ommunication* focus addressed alignments and linkages for effective two-way information flow between government agencies and producers. Early stage engagement with all stakeholders is paramount to successful policy development, implementation and adoption of improved practices. There seems to be a lack of consistency among state and federal agencies regarding scientific analysis and/or sharing of data. Similarly, a disconnect exists between agencies and policy-impacted producers regarding acknowledgement of water quality issues, producers' contributions to these issues and the availability of technically/economically viable means to address the concerns. While the record of recent Agency activity indicates a growing appreciation for and understanding of the concepts of public conflict management, sensitivity to the various views and agendas of groups and individuals continues to be a challenge. For example, should the Agency attempt to be an honest broker-facilitator at the same time it is operating in an enforcement role? Consideration of collaboration among state and federal agencies and affected parties may be trumped by compromise or narrowly interpreted laws. While science may be at the heart of the contentious debates, it may not have a solution to such dilemmas. Scientifically based innovation is bringing the science of management to conflict resolution, but it remains a challenge.

MAIN OBSERVATIONS / INSIGHTS

Models and Standards

Nutrients and SABS [often measured as concentrations of total suspended solids (TSS) or turbidity units] at elevated concentrations can cause designated use impairments to certain water bodies. Whether use impairments occur in response to different stressors is influenced by many natural factors. Water body classes and characteristics must be considered in assessing the level at which nutrients or SABS impair designated uses. Criteria and numeric standards should be developed using a transparent and science-based weight-of-evidence approach. This approach should identify the biological effect resulting in a designated use impairment of the water body, quantify levels of the stressor that causes the use impairment, and address uncertainty in the models and data used for the development of the criteria. EPA's current guidance on nutrients should be updated taking into account the 2010 and 2011 scientific peer review panel recommendations. Additional guidance is needed on criteria and standards for SABS.

An extremely useful process available to the management of individual watersheds is *adaptive management*. It is a structured, iterative process of optimal decision making in the face of uncertainty, with an aim to reducing uncertainty over time via system monitoring. In this way, decision making simultaneously maximizes one or more resource objectives and, either passively or actively, accrues information needed to improve future management. Because adaptive management is based on a learning process, it improves long-term management outcomes. We believe adaptive management can be effective in the continuing improvement of managed ecosystems, allowing for continuous adjustment of models and policies to create an optimal outcome. Additional research is needed to help identify and quantify the effectiveness of BMPs and technology for reducing agricultural nutrient and total suspended solids loads. This research should include an analysis of the overall costs associated with load reduction of the stressors in comparison with the benefits achieved for water quality and the benefits of the agricultural land use.

Details regarding the model uncertainties and nutrient and SABS criteria and standard discussions can be found in Appendix A.

Economics

The role of economic analysis in water policy provides opportunities to estimate actual and potential benefits and costs of an array of relevant alternative solutions and their respective likely consequences. While water quality is a hydro-biologic concept, with human activity, water quality cannot be achieved, maintained, monitored or improved without financial resources. Thus, inclusion of economic benefits and costs is essential to analysis, implementation, assessment and review.

Many issues impact the reliability and relevance of economic analyses to the policy making process. Some of these issues are: 1) existence and use of consistent guidelines for economic analyses, 2) timing and triggering of economic analyses, 3) expertise and other collaborative requirements and 4) scientific peer review.

Our investigation suggests that the EPA's recently released guidelines (EPA, 2010) address many of the important theoretical and methodological considerations in economic analysis in detail (including needed transparency of assumptions and data used, and potential limitations of scope and scale in analyses). Furthermore the investigation suggests a general awareness and adoption of these guidelines across the Agency and by others who conduct analyses for EPA. However, in order to best enhance the relevancy and effectiveness of economic analyses, other issues still require further consideration including review of the timing and triggering mechanism for analyses, development and enforcement of a peer review process for EPA and other parallel/counter analyses, and protocols/mechanisms for the inclusion of appropriate scientific expertise and information in an analysis. More details regarding the economic insights can be found in Appendix B.

Communication

Effective communication for improvements to water quality requires that high quality data (scientific and economic) be generated and shared as early as possible with appropriate stakeholders. Validated models, cost/benefit analyses and a clear understanding of the regulatory decision making process are essential elements of successful outreach.

Inconsistencies in messaging within and between government agencies must be avoided to develop productive and practical approaches to improving water quality. In the past, antagonism and inertia have been the result of poorly communicated data, a misunderstanding of the regulatory process and competing water quality goals.

Farmers and ranchers are most likely to understand and embrace the need for changes in agricultural practices when credible data are shared through trusted technical sources. A successful approach requires the commitment of a diverse group of stakeholders and local innovators to lead this type of transformation. An ongoing outreach program to provide updates on new developments in science, technology and regulations is needed to maintain visibility and to promote a culture of continuous improvement in protecting natural resources.

Examples of water quality related issues, programs or regulatory provisions that will need to be more effectively communicated include:

1. Establishing the criteria for Clean Water Act water quality standards (WQS) for nutrients (P&N), sediment loading, biological oxygen demand, and other WQS that can be affected by agricultural activities.
2. Administering the Clean Water Act NPDES permit program for confined animal feeding operations (CAFOs) that can be point sources for water pollution.
3. Overseeing Clean Water Section provisions that require states to assess both point source and nonpoint source water pollution, including pollution from agricultural sources.
4. Overseeing Total Maximum Daily Load (TMDL) provisions that may result in state level controls for agricultural sources of surface water pollution.
5. Funding, oversight and evaluation of scientific research and investigation concerning agriculture and water quality.

A broad array of groups contribute to effective transfer of information, including federal, state, local agencies, as well as non-governmental organizations and private organizations. A list of insights as to strengths and weaknesses of each entity, as well as examples of successful communication efforts, are included in Appendix C.

RECOMMENDATIONS

Models and Standards

We support several of the recommendations made by the 2004, 2010 and 2011 Science

Advisory Boards on models and methodology used in the development of water quality nutrient and SABS criteria and the methods used in the derivation of numeric standards. We have included several of them in our recommendations below and suggest that EPA guidance documents be amended to include those recommendations.

Develop nutrient and SABS (suspended and bedded sediments) criteria that are science-based, transparent and demonstrate that the nutrient or sediment in fact causes an adverse biological effect on the designated use for the water body.

- Development of nutrient and SABS criteria should be based on a transparent and science-based demonstration that the nutrient or sediment is causing an adverse biological effect on the designated use for the water body.
- Additional guidance should be developed on SABS (including TSS and turbidity) criteria using biological endpoints related to the impairment of designated uses in different water body classes.

Calibrate the models and data appropriately to the size and class of the watershed and its designated use.

- In many cases, there are limited monitoring data available for use in watershed modeling. Thus, it is often hard to find sufficient quality data to 1) give flow, nutrient and sediment concentrations on which a model can be calibrated, 2) adjust the model so that it best reflects the measured values, and 3) test the model using a different time period of monitoring data, to assess performance. For example, monitoring data for an 8-digit HUC watershed used to calibrate a model might be inappropriately used to estimate discharge from smaller 12-digit sub-watersheds for area prioritization. As models are used more frequently and over wider areas, this misuse is becoming more of a concern.
- Additional guidance should be developed to identify and characterize the important factors influencing the interactions between nutrients or SABS and cultural eutrophication in different water body classes including man-made channels such as drainage ditches.

Identify and quantify the effectiveness of agricultural BMPs.

- Use CEAP studies to identify and quantify the effectiveness of BMPs and emerging technologies being employed on farms and ranches to reduce agricultural nutrient and SABS loads.
- Prioritize water quality issues using readily available vetted criteria like the 303(d) listed watersheds.
- Consider "certainty mechanisms" that encourage farmers and ranchers to implement approved voluntary resource conservation practices by providing them safe harbor in further regulatory action.

Follow a weight of evidence approach to establishing criteria.

- Data, methods and models used to develop criteria and establish numeric standards should not rely solely on the reference condition or any other single approach, but instead should be based on the broader weight of evidence.
- Weight of evidence approaches should evaluate and document uncertainties in the data, models and methods as well as environmental factors in the water body that can change

the impact of the stressors on impairment of the designated use (e.g., water color or depth). Such an approach will assure informed mitigation management decisions can be made and the body of water can be restored to its designated use.

Apply Downstream Protection Values (DPVs) only when there is impairment downstream.

- DPVs should be applied only when rigorous analyses show that mitigation practices in upstream watersheds can help restore the designated use of the downstream water.

Use adaptive management as a primary management tool for mitigation of nutrient and SABS off-site movement to water from agricultural operations.

- When criteria and numeric standards are developed using the best available science and they connect levels of nutrients or TSS to an unreasonable adverse effect or impairment of the designated use for a body of water, adaptive management practices should be implemented and the standards enforced.
- In instances where numeric criteria have not been developed and the designated use of the water body is impaired due to levels of nutrients and/or SABS, loads should be reduced according to a schedule over time and a protocol developed on how to measure improvements in water quality.
- Use CEAP studies to identify and quantify the effectiveness of BMPs and emerging technologies being employed on farms and ranches to reduce agricultural nutrient and SABS loads.
- Partner with NRCS to link CEAP studies to 303(d) lists to help identify vulnerable lands in watersheds.
- Partner with NRCS and FSA to help target USDA conservation programs for water quality improvement.
- Provide guidance to USDA and land grant institutions on EPA priorities for additional research on BMPs. New technologies and new varieties with improved nutrient use efficiency are critical to improving on-farm efficiencies.
- Consider "certainty mechanisms" that encourage farmers and ranchers to implement approved voluntary resource conservation practices by providing them safe harbor in further regulatory action.

Fund, conduct and incorporate additional research.

- Research should examine the overall costs associated with load reduction in comparison with both the benefits of water quality improvements and the benefits of agricultural land use. Cost and benefit analyses, including farm-level impacts, should be conducted on regulatory approaches and mandates to achieve water quality goals.
- EPA should provide guidance to USDA and land grant institutions on EPA priorities for additional research on BMPs, new technologies and new plant varieties with improved nutrient use efficiency that are critical to improving on-farm efficiencies.

Economics

We support the 2010 EPA document *Guidelines for Preparing Economic Analyses* and make the following recommendations for improvements.

Encourage consistent use of these guidelines for all analyses of EPA regulatory action.

- Economic analyses of EPA regulatory actions are often initiated outside of EPA – whether by other government agencies, states or stakeholder groups. Following similar guidelines facilitates interpretation of results and comparison across studies.

Revise criteria used for the timing and triggering of economic analyses.

- EPA sanctioned analyses are triggered if regulatory action meets requirements of certain executive orders (e.g., when the action is expected to cause $100 million in impacts) and statutes (e.g., when action impacts small businesses or local governments). While limited resources can affect the timing and scope of analyses, the $100 million floor entirely misses the point that for rural economies, the potential impacts can be much less than that, yet still be significant in the life of the community and its residents. Furthermore, analyses trigged by the small business impact may not fully account for the firms that can be greatly impacted through multiplier effects. Therefore, procedures that trigger economic analyses when agriculture may be impacted by regulation should be put in place.

Require an independent review process.

- These guidelines should be amended to identify and enforce a scientific review process that is timely, transparent and independent. EPA should require that all EPA sanctioned evaluations of the economics of agriculture and nutrient standards be reviewed by USDA ERS personnel or other designated scientists.
- Parallel and counter studies that expect to influence the policy process should be encouraged to undergo (and show proof of) a scientific peer review and transparency process similar to what is expected of government.

Design and foster a mechanism for effective collaboration.

- The guidelines should include protocols and mechanisms for the involvement of needed scientific expertise and gaining access to relevant data across state and federal agencies. The agreements should be further extended to private sector and policy-target stakeholders in order to improve the relevancy and reduce omission of important considerations (e.g., local impacts) from the economic analyses. Economic analyses that omit inclusion of relevant expertise or information should be rejected during the independent review process.

Communication

The following areas have been identified as important to communicating science at the technical, regulatory and field levels.

Develop a coordinated public engagement plan at the national, regional and local levels to exchange agricultural and environmental quality issue information.

- Identify and reach out to key leaders (state and local grower associations, land grant extension, tribes, minorities and other key leadership) early on in the process to ensure that industry understands that there is a water quality issue.
- Develop appropriate outreach materials to explain the science behind practices, impacts and water quality goals.

<u>Improve intra-agency communication.</u>

- Each government agency must develop appropriate supporting data and a common understanding of environmental goals within each organization.
- Regional and headquarters offices of government agencies should be in agreement on approach to issues to avoid undermining of credibility and trust of any research or regulatory program.

<u>Improve coordination among government agencies.</u>

- The Regional Administrators and Regional Agricultural Advisors should establish a transparent process to coordinate data-sharing across agencies and other stakeholders.
- Many agencies work on the same environmental issue; early stage identification of the role and authority of each arm of government is essential in developing synergy towards a common environmental quality objective. A lack of coordination creates a general lack of trust not only among the agencies themselves, but especially with the regulated community.
- Leadership at high levels of each agency should agree on objectives, roles, authority and approaches to each issue in order to move forward in a complimentary manner and to periodically assess effectiveness in programs. Agencies involved in water quality issues include EPA, USDA, USGS, FWS, NMFS, land grant universities and state lead agencies.
- Agencies should use similar models and terminology for agricultural practices. For example, NRCS uses Conservation Practice Standards (CPS) for agricultural conservation measures. EPA in the Clean Water Act Section 319 program and other programs uses the term "Best Management Practices (BMP)." A CPS and BMP addressing the same practices and concerns should use the same terminology and have the same goals.

<u>Provide accurate information that facilitates dialogue among regulators, farmers, ranchers and rural communities.</u>

- Demonstrate BMPs at the farm level to facilitate understanding of the connection between on-farm practices and potential impacts on water quality.
- The opportunity for input by farmers and ranchers to improve practical approaches and development of regulations will increase rate of adoption of practices and assist in building trust with government agencies.

<u>Identify Sources of Information.</u>

- Identify all stakeholders and networks that can provide information to farmers and ranchers adjusting for inherent strengths and weaknesses of each group.

CONCLUSION

Effective water quality management must rely on the science-based process of discovery. That process must address not only the technical issues of cause and effect but also the economic implications of policy decisions. Open and effective communication is a key component that helps to inform the science and to implement policy. The recommendations provided in this report offer opportunities for EPA to adopt a comprehensive, interactive and flexible approach to science-based water quality regulation that can strengthen the process continuous improvement through adaptive management.

APPENDICES

A. Models and Standards Subgroup Report
B. Economics Subgroup Report
C. Communications Subgroup Report

Appendix A
Models and Standards Subgroup Report

Nutrient and Suspended and Bedded Sediments (SABS) Criteria and Standards for Water Quality

For a timeline on background information on numeric nutrient and SABS criteria, see Attachment A.

1. NUMERIC NUTRIENT CRITERIA

1.1 Background

In 1998, EPA issued its National Strategy for the Development of Regional Nutrient Criteria (EPA 822-R-98-002). This document identified nutrients as a primary cause of designated use impairment (e.g., excessive plant growth, ecosystem imbalance, dissolved oxygen criteria violations) in the United States and presented a strategy to address this concern. The strategy called for EPA to accelerate development of scientific information on the levels of nutrients that cause use impairments for various water bodies and for the States to develop regional nutrient criteria. EPA developed and distributed guidance to help States develop individual numeric nutrient criteria (Memorandum from Geoffrey Grubbs, November 14, 2001). In response to a 2007 Memorandum from Benjamin Grumbles (May 25, 2007), the Association of State and Interstate Water Pollution Control Administrators [Letter from Association of State and Interstate Water Pollution Control Administrators (ASIWPCA) to Grumbles, July 18, 2007] noted that all its members have been actively working to develop nutrient criteria; however, many states are failing to find a strong linkage between EPA's causal variables (N and P) and the response variables (e.g., chlorophyll-a). EPA acknowledged this lack of linkage when it proposed numeric nutrient criteria for streams in Florida.[3] In 2009, EPA's Office of Inspector General released a report identifying numeric nutrient criteria development as a problem requiring corrective action (Report No. 09-P-0233, August 26, 2009).

In a separate development, EPA was sued by environmental groups in Florida, claiming the Agency was required by law to establish criteria for nutrients because the state had failed to do so. To settle the lawsuit, EPA issued a letter of determination notifying the State of Florida that new or revised numeric nutrient standards were necessary to meet the requirements of the Clean Water Act (Letter from Benjamin Grumbles to Michael Sole, January 14, 2009). Approximately one year later, as required by a consent decree, EPA published draft numeric nutrient criteria for Florida. These draft criteria were promulgated in December 2010 and are currently the focus of a legal challenge by municipal, industrial and agricultural groups in Florida.

1.2 EPA Progress

The establishment of water quality criteria for nutrients is complicated for a number of reasons. Most other criteria have been developed for parameters that cause toxicity at concentrations in excess of some threshold for an adverse biological effect or unreasonable adverse effect.

[3] 75 Fed Reg 4215. January 26, 2010. "EPA also concluded that a scientifically defensible cause and effect relationship could not be demonstrated with the available data" relating nutrients to biological impairment metrics.

Nutrients, however, are necessary for the maintenance of healthy aquatic ecosystems and do not exhibit threshold effects that are easy to model, due to a wide range of environmental confounders. EPA recognized these concerns and developed guidance to address these issues. These methods and the resulting numeric criteria are discussed below.

1.2.1 Guidance on Methods

In accordance with the National Strategy, EPA published several guidance documents for the development of numeric nutrient water quality criteria. The documents most applicable to the agricultural community include EPA's guidance for Rivers and Streams (EPA-822-B-00-002, July 2000) and for Lakes and Reservoirs (EPA-822-B-00-001, April 2000). In addition, guidance documents are available for Estuarine and Coastal Marine Waters (EPA-822-B-01-003, October 2001) and Wetlands (EPA-822-B-08-001, June, 2008). More recently, EPA issued guidance on Using Stressor-response Relationships to Derive Numeric Nutrient Criteria (EPA-820-S-10-001, November 2010) following a Science Advisory Board review. These documents are available on EPA's website (http://water.epa.gov/scitech/swguidance/standards/criteria/nutrients/guidance_index.cfm).

The guidance documents present three different methods that are applicable for deriving numeric nutrient water quality criteria: nutrient reference conditions, stressor-response relationships and mechanistic water quality models.

- ***Reference Condition***

The Reference Condition approach is a method developed by EPA to characterize the nutrient concentration or response variable characteristic expected for relatively undisturbed (reference) water bodies, supporting their designated uses that can serve as an example of the natural biological integrity of a region or class of water bodies. Measurements from multiple water bodies within the class are collected and sorted based on increasing concentration. The reference condition is then determined using a specific percentile from the frequency distribution of the data set. The selection of the percentile value depends upon the quality of the database. EPA guidance suggests using the 75^{th} percentile of the distribution if the dataset is composed of reference sites. Where the number of reference sites is insufficient and the database includes non-reference water bodies, a lower percentile would be selected, as illustrated in the graph below from the Rivers and Streams guidance (EPA-822-B-00-002 at 96).

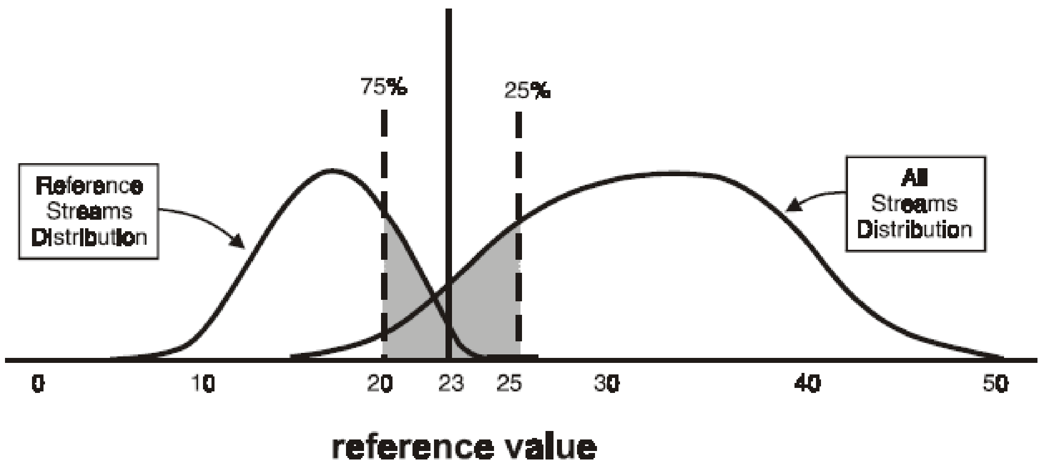

Figure 8. Selecting reference values for total phosphorus concentration (μg/L) using percentiles from reference streams and total stream populations.

- ***Stressor-Response Relationship***

A Stressor-Response relationship is a model that relates the stressor concentration (nitrogen, phosphorus) to a response metric (e.g., chlorophyll-a) that is associated with the designated use of the water body type from which the data originated. EPA published guidance on the application of this method to develop numeric criteria for nutrients (EPA-820-S-10-001). This guidance document was the subject of a Science Advisory Board (SAB) review (SAB Review of Empirical Approaches for Nutrient Criteria Derivation. April 27, 2010. EPA-SAB-10-006). The SAB report is available on the web at: http://yosemite.epa.gov/SAB/SABproduct.nsf/0/5972e2a88464d45e85257591006649d0!OpenDocument&TableRow=2.3#2.

The figure below presents an example of a simple linear regression from the guidance document (EPA-820-S-10-001 at 39) for a single lake. Total nitrogen (TN) is the stressor, and the response variable is chlorophyll-a (phytoplankton). Prediction intervals are illustrated to show the range of the stressor concentrations that may elicit the response. If use impairment occurs at chlorophyll-a levels in excess of 20 µg/L, the regression shows a 90 percentile prediction range of 0.66 – 1.56 mg/L TN.

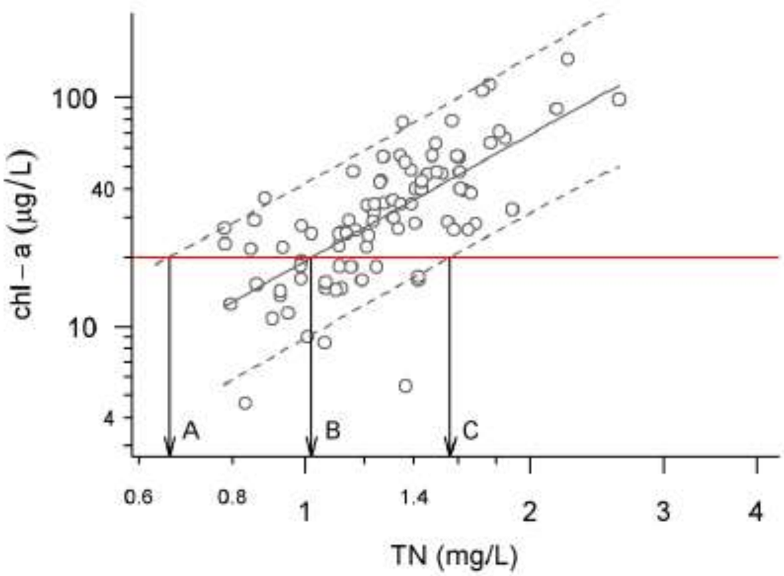

Figure 4-4. Total nitrogen (TN) versus chl *a* in one lake collected during March-August over 10 years. Solid line: linear regression fit. Dashed lines: upper and lower 90th prediction intervals. Red horizontal line: chl *a* = 20 µg/L. Note that upper prediction interval has been extended beyond the range of the data to estimate the point at which it intersects the chl *a* threshold. Arrows indicate candidate criteria associated with different prediction intervals and the mean relationship. See text for details.

- ***Mechanistic Water Quality Models***

Mechanistic water quality models present detailed characterizations of the interaction among the nutrient stressors, the response variables associated with use attainment and the multiple biological and non-biological factors that influence this response. In contrast to stressor-response analyses that rely on empirical statistical analysis, mechanistic models attempt to explicitly simulate the ecological processes that are operating in a given water body to predict the designated use-related response. Such models start with a conceptual diagram that depicts the accepted scientific knowledge concerning the pathways that lead from nutrient loading to use impairments. The model accounts for the significant relationships in order to predict the response of the system. An example of a simplified conceptual diagram for plant growth is presented below from the Water Quality Analysis Simulation (WASP) model documentation (EPA-600/R-06/106; Figure 2 at 3).

In lakes, growth of phytoplankton (algae suspended in the water column) is generally the primary type of plant growth, and water column concentrations of nutrients remain relatively constant over time. With appropriate classification to account for significant confounding factors (e.g., water color, turbidity, depth), stressor-response relationships have been shown to provide reasonable projections of chlorophyll-a response (See Attachment B).

The corresponding conceptual diagram for streams is significantly more complicated. In streams, growth of periphyton (algae attached to hard surfaces such as rocks) is generally the primary type of plant growth. Nutrient concentrations in the water column vary widely depending upon flow and in response to runoff. Light may be limited by the tree canopy, and

SABS [commonly measured as total suspended solids (TSS) or in turbidity units] and periphyton may be scoured from the stream in response to elevated flows. As a consequence, stressor-response relationships generally provide poor estimates of plant growth in streams as noted by ASIWPCA (July 18, 2007) and EPA (75 Fed Reg 4215).
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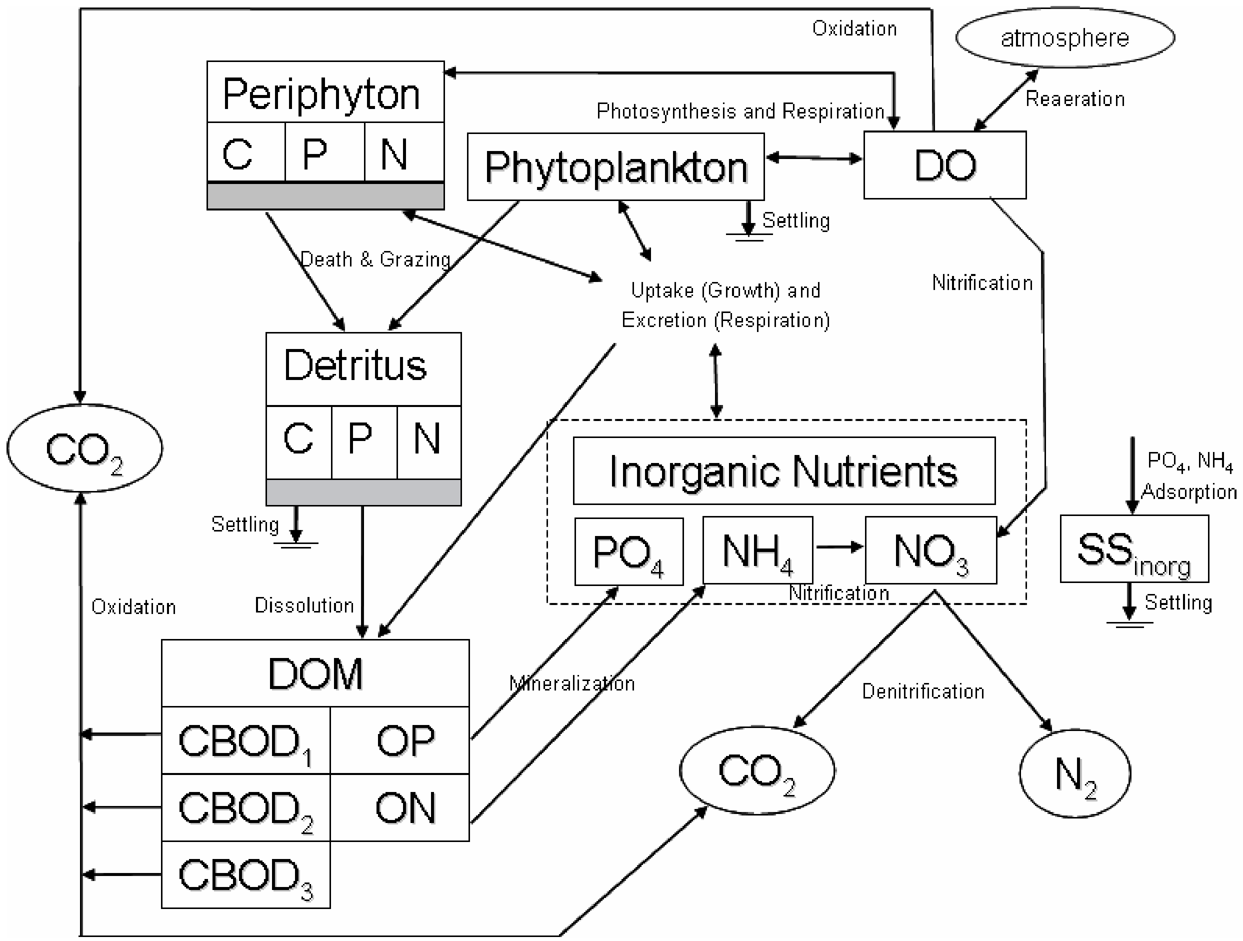

Figure 2. WASP Version 7 Eutrophication Kinetics.

Mechanistic models, when properly constructed, result in less uncertainty than other methods that measure results of controls on a particular stressor to yield a specific response. However, a model constructed for a particular water body type and size generally cannot be applied to other water body types and sizes because in most cases characterization of the specific conditions in the first water body type cannot be extrapolated to the second.[4]

[4] In encouraging the states to enhance efforts to develop nutrient criteria, EPA commented that notable progress has been made relying on site-specific application of narrative standards to develop nutrient TMDLs. (Memorandum from Benjamin Grumbles. May 25, 2007). This is a reference to the mechanistic modeling approach used in TMDLs and is site-specific (e.g., only applicable to the water body being modeled).

In addition to this guidance, EPA issued a memorandum to its Regional Administrators[5] and presented a framework for managing nitrogen and phosphorus loads prior to the development of nutrient criteria, including recommendations for agricultural areas (BMPs and verification measures on effectiveness).

The stressor-response and mechanistic modeling methods both relate nutrients to instream responses in a manner that is appropriate for criteria development. The reference condition method can be useful as a means to determine ambient nutrient concentrations under certain relatively undisturbed conditions. However, since this determination is unrelated to use impairment, it is not appropriate to use as a stand-alone method for deriving criteria intended to protect designated uses.[6] Moreover, the reference analysis yields conditions that may not be able to be achieved in certain agricultural areas without removing agricultural uses, and analyses to determine use impairment using other models and methods is an important part of the step-wise process for criteria development. Agricultural uses are important not only to specific farms that are seeking profitability and sustainability, but to local and regional economies that rely on the agricultural activity for economic development. While protecting the environment is a primary objective of EPA, it is important that the Agency consider the total benefits and costs of regulatory mandates, including the farm-level impacts.

1.2.2 SAB Recommendations

EPA's Science Advisory Board has reviewed much of the guidance provided by EPA on the derivation of numeric nutrient criteria. One of the recent reviews involved a consideration of draft guidance on using stressor-response relationships to derive numeric nutrient criteria (April 2010). These reviews include pertinent observations and recommendations on demonstrations necessary to support scientifically defensible nutrient criteria.

The SAB's report on EPA's draft stressor-response guidance contained many recommendations for improving the EPA's draft document and several cautions concerning its use. In its cover letter transmitting the report, the Board noted:

> *"The empirical stressor-response framework described in the Guidance is one possible approach for deriving numeric nutrient criteria, but the uncertainty associated with estimated stressor-response relationships would be problematic if this approach were used as a 'stand alone' method because statistical associations do not prove cause and effect. We therefore recommend that the stressor-response approach be used with other available methodologies in the context of a tiered approach where uncertainties in different approaches are recognized, and weight-of-evidence is used to establish the likelihood of causal relationships between nutrients and their effects for criteria derivation." (EPA-SAB-10-006 at ii)*

[5] Nancy Stoner, Acting Assistant Administrator. March 16, 2011. Working in Partnership with States to Address Phosphorus and Nitrogen Pollution through Use of a Framework for State Nutrient Reductions.

[6] External Expert Peer Review Comments on Draft Ecoregional Nutrient Criteria Documents. June 2001. "Reference conditions alone cannot be used to derive criteria. Need to use the "weight of evidence approach" which addresses all the key elements of nutrient criterion development." (at 1). Available on EPA website at http://water.epa.gov/scitech/swguidance/standards/criteria/nutrients/upload/2007_09_27_criteria_nutrient_ecoregions_peerrevncritdocs.pdf.

This comment presents several important considerations in deriving criteria for nutrients that are scientifically defensible. With regard to the stressor-response method, this is an empirical, statistical analysis that includes a certain amount of uncertainty. This uncertainty was illustrated in the example presented above regarding the 90th percentile prediction interval for chlorophyll-a versus TN in one lake. More importantly, this empirical method presumes that the stressor (e.g., TN) causes the response (chlorophyll-a). The SAB cautioned that such a relationship should be confirmed. Without such confirmation, there is little confidence that managing for TN will produce the desired effect. Finally, and perhaps most importantly, the SAB recommended that uncertainties in the various approaches need to be considered and evaluated in a tiered assessment to confirm the causal relationships so that mitigations will achieve the targets for the designated use. The uncertainty that will remain requires careful consideration, and any criteria developed using these methods need to include flexibility such that nutrient controls result in designated use restoration as opposed to simply achieving a nutrient target concentration.

1.2.3 Florida Experience

EPA published final numeric nutrient criteria for Florida's lakes and flowing waters in December 2010 (75 Fed Reg 75762). The lake criteria were developed using a stressor-response regression analysis to independently relate the stressors (TN and TP) to the response variable (chlorophyll-a, algae) after defining chlorophyll-a criteria based on trophic state. Independent criteria for TN, TP and chlorophyll-a were developed for colored lakes and two types of clear lakes. If a lake exceeded the TN or TP criteria but met the chlorophyll-a concentration, the criteria allowed for an adjustment in the TN or TP criterion within a predetermined range.

Stream criteria were developed for five nutrient regions within the state. EPA indicated that it was difficult to establish a scientifically defensible cause and effect relationship between nutrients and use impairment. Consequently, EPA relied on the distribution of nutrient concentrations in minimally disturbed streams to establish numeric nutrient criteria. Minimally disturbed streams were identified using screening criteria originally developed by the Florida Department of Environmental Protection (DEP) and modified by EPA. One of the screening criteria looked at landscape development intensity (LDI) and limited reference streams to reaches without significant human disturbance within 100 meters of the stream bank and tributaries within a 10 kilometer radius upstream of the sampling point. Another screening criterion looked at the stream condition index – a macroinvertebrate metric used by Florida DEP to determine whether a stream was meeting its aquatic life use.

As discussed above, the stream criteria were developed from an analysis of minimally disturbed nutrient concentration distribution, and the lake criteria were developed from stressor-response evaluations. In the case of streams, the criteria were not related to use impairments (*supra* at 2 see footnote), so their ability to mitigate impairment is unknown. With regard to lakes, there was no demonstration that TN or TP "caused" the observed response.[7] Consequently, there is no assurance that managing for a particular nutrient level will lead to the desired outcome.

[7] See Technical Support Document for U.S. EPA's Final Rule for Numeric Criteria for Nitrogen/Phosphorus Pollution in Florida's Inland Surface Fresh Waters. Chapter 2.

If it is assumed that nutrient levels need to be near reference levels to ensure use attainment, then certain streams traversing agricultural areas may need significant riparian buffers to mitigate the effects of agricultural land use. In this case, an LDI ≤ 2 was considered necessary to mitigate these effects. Based on information contained in the Technical Support Document[8], certain streams would require a forested buffer of 250 feet on either side of the stream to meet this requirement. Such expansive buffers are not consistent with certain agricultural land uses, and the development of alternative BMPs, consistent with agricultural land use, is necessary. More research is needed to develop appropriate BMPs and to quantify their effectiveness. Implementation of BMPs may be costly, and the cost of compliance should be evaluated along with the value of the designated use restoration and the value of the agriculture land use.

The final numeric criteria adopted for Florida did not address estuaries, marine waters or flowing freshwater in South Florida. These are the subject of future EPA rulemaking and a final SAB report (See, "Review of EPA's draft Approaches for Deriving Numeric Nutrient Criteria for Florida's Estuaries, Coastal Waters, and Southern Inland Flowing Waters"; EPA-SAB-11-010, July 19, 2011). EPA proposed using the three methodologies to derive numeric nutrient criteria for these waters, as summarized in the SAB reports:

> *"The EPA document notes that EPA may use one, two or all three of these approaches for a particular water body. There would be a greater confidence in the criteria if multiple approaches were applied to each of the systems for which data and models are available. This would provide an ensemble approach and a range of values for setting numeric criteria. However, this could result in more than one answer as to what numeric values would be protective. This is understandable given the different conceptual bases for each approach, but the EPA document should discuss how the results from multiple approaches would be integrated to develop the final numeric criteria." (EPA-SAB-11-010 at 9-10)*

This comment is similar to the comments made by the Science Advisory Board in 2010. The 2011 Board also considered EPA's proposed approach for addressing South Florida inland-flowing waters that may be particularly applicable to certain agricultural areas. The Board noted:

> *"[W]aters included in this category are dominated by man-made canals and the SAB is not convinced from the material provided that nutrient criteria are appropriate for these uniquely artificial and highly managed ecosystems." (EPA-SAB-11-010 at 23)*

The SAB review provides multiple reasons why criteria for man-made channels may not be appropriate, and these reasons may be applicable to drainage ditches and canals servicing agricultural lands. The difficulties in establishing appropriate response thresholds to protect designated uses may also apply to drainage ditches and canals.

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[8] Technical Support Document for U.S. EPA's Final Rule for Numeric Criteria for Nitrogen/Phosphorus Pollution in Florida's Inland Surface Fresh Waters. Appendix A.3.1 presents the LDI method for streams and includes LDI values for specific land uses. Row and field crops have an LDI = 4.63. Various types of forested lands have an LDI = 1.0.

1.2.4 Independent Applicability

Water quality standards are instream threshold concentrations, above which designated uses (aquatic life, water supply, recreation) become impaired and below which use attainment is likely. The presence of nutrients may allow impairment to occur due to excessive plant growth and the problems associated with excessive growth (hypoxia, imbalance in natural populations). The actual "impairment" is evidenced by excess algal growth, dissolved oxygen standard violations attributed to excessive algae, or imbalanced populations of flora or fauna. Nutrient criteria include numeric values for TN and TP and may also include numeric values for turbidity, algal levels and population metrics. Each of these criteria is independently applicable. Thus, if a water body exceeds the TN or TP criteria, it is currently considered impaired, regardless of whether excess algae growth or imbalanced populations are present. (See Letter from Nancy Stoner, Acting Assistant Administrator - EPA to Ronald Poltak, Executive Director - New England Interstate Water Pollution Control Commission. March 1, 2011)

In review of the various methods proposed by EPA to develop nutrient criteria and the comments provided by the SAB, flexibility is needed to ensure that nutrient controls meet the targets for use restoration, as opposed to achieving a nutrient target concentration. If the designated use is achieved based on eutrophication metrics (such as chlorophyll-a or a macroinvertebrate index), then the water body should not be considered impaired because a nutrient concentration is above the numeric nutrient standard.

1.2.5 Downstream Protection

The EPA Guidance on Rivers and Streams notes that nutrient criteria must first meet the optimal nutrient conditions for that stream class and then be reviewed to ensure the level proposed does not result in adverse nutrient loadings to downstream water bodies (Guidance 13). This approach was also used by EPA in Florida. Under the Florida rule, upstream criteria may be set equal to the downstream criteria if the downstream waters exceed their criteria. If the downstream waters meet the applicable nutrient criteria (e.g., nutrient concentrations and chlorophyll-a), the downstream protection value (DPV) may be set equal to the existing ambient concentrations at the point of entry into the downstream water body.

This approach can lead to an assumed total maximum daily load (TMDL) applied to upstream waters, whether or not the downstream waters are impaired and whether or not the upstream waters are causing the impairment if it exists downstream. EPA's Science Advisory Board (EPA-SAB-11-010, July 19, 2011) reviewed and commented on this approach, noting that the DPV overlaps with the TMDL process, but does not include any of the flexibility afforded when a TMDL is developed. This approach is particularly complex and challenging because nitrogen and phosphorus can be transported to the ocean, and therefore marine nutrient criteria could drive upstream criteria for rivers and streams a thousand miles or more from the sea. The models used to develop the DPV do not yet include assessments of environmental fate characteristics that can remove nutrients from downstream waters or otherwise transform nutrients into forms that do not cause eutrophication.

1.3 State Positions on Nutrient Criteria Development

Since the National Strategy was issued in 1998, the states have been working to develop their own numeric nutrient criteria at varying paces. In response to the 2007 Memorandum from Benjamin Grumbles, ASIWPCA responded (July 2007) by noting many states are failing to find a strong linkage between nutrients and use impairment.

1.3.1 Approaches Being Used

Most states have followed EPA guidance in an effort to develop numeric nutrient criteria, including derivation of reference-based concentrations for total nitrogen and total phosphorus. In addition, most states have used stressor-response evaluations in an attempt to derive nutrient criteria related to metrics of use impairment. At this time, mechanistic modeling approaches are apparently not being used widely as the basis for criteria development.

As noted in an ASIWPCA letter to the Administrator[9], these efforts are generally not resulting in strong cause-and-effect based relationships, and most states have not adopted numeric nutrient criteria for streams. Several states have adopted selected criteria applicable to lakes, and some states have existing stream standards. Examples are presented below.

State	Water/Parameter	Comments
Minnesota (7050.0222)	Lakes: TP, Chl-a, transparency	TP criteria do not trigger use impairment unless eutrophication standard exceeded
Wisconsin	Lakes: TP Streams: TP	Independently applicable Independently applicable
New Jersey (7:9B-1.14)	Lakes: TP Streams: TP	Independently applicable Applied if causing excessive algal growth

The status of all the states with regard to numerical nutrient criteria is available at: http://water.epa.gov/scitech/swguidance/standards/criteria/nutrients/progress.cfm.

Of the states with numeric nutrient criteria for lakes and streams, most have developed criteria for phosphorus, but only a handful have developed corresponding criteria for nitrogen. This circumstance derives primarily from a consideration of limiting nutrients; under certain fresh water situations phosphorous mitigation alone can achieve plant growth control targets. If criteria are developed using EPA's proposed methods and in consideration of the recommendations made by the SAB, the independent applicability of the numeric nutrient standards may not be needed to meet designated use goals.

1.3.2 State Challenges

Many states have not adopted TN criteria for fresh waters, and in certain cases the nutrient criterion does not apply unless it is associated with a eutrophication standard exceedance (e.g.,

[9] Association of State and Interstate Water Pollution Control Administrators (ASIWPCA) letter to the EPA Administrator Jan 31, 2011. Available at http://wetweatherpartnership.com/WWPWebDocuments/Storm%20Water/2011-01-31%20ASIWPCA%20Ltr.pdf

excessive chlorophyll-a, reduced transparency). EPA has requested states to apply nutrient criteria independent of eutrophication standard exceedances (i.e., where use impairments are not occurring). EPA is also requesting states to adopt TP and TN criteria for all waters (*supra* at 4; Letter from Nancy Stoner).

2. SUSPENDED and BEDDED SEDIMENTS (SABS) CRITERIA [includes Total Suspended Solids (TSS) and Turbidity Criteria]

2.1 Background

The EPA acknowledges that sediments pose a significant concern for use impairment in the nation's waters; however, EPA has not developed guidance on the development of SABS water quality criteria (inclusive of TSS or turbidity criteria). As with nutrients, the development of numeric criteria for sediment is complex, and the various methods to establish numeric standards include uncertainty that must be characterized and considered as the criteria are developed and mitigation practices are implemented. Sediment control is further complicated by the fact that often the stream bank is the primary source of sediment in response to elevated flow. Consequently, the rate of inflow becomes a controlling factor with regard to mitigation. Like nutrients, most states currently address sediment-related use impairment via their narrative criteria. Sediments occur naturally and are essential to the ecological function of a water body. Under natural conditions, suspended solids and bedded sediments transport nutrients, detritus and other organic matter through a water body, replenish scoured materials and create habitat. In excessive amounts, suspended and bedded sediments constitute a major stressor, while sediment starvation due to settling behind impoundments also causes stress.

2.2 EPA Progress

EPA has developed a framework for a process to use in developing suspended and bedded sediments (SABS) water quality criteria. However, EPA does not currently have guidance on criteria for SABS (including TSS and turbidity). EPA developed a set of potential approaches for criteria development in 2003[10] and reviewed these approaches with the Science Advisory Board. The EPA report notes that the basic premise for managing suspended and bedded sediments may be the need to maintain natural or background levels, but improved criteria may be developed to protect aquatic life using the following methods:

- Toxicological Dose-Response Approach
- Relative Bed Stability and Sedimentation Approach
- Conditional Probability Approach (Establishing Thresholds)
- State-by-State Reference Conditions
- Fluvial Geomorphic Approach
- Use of New State/International Approaches

[10] EPA Office of Water, Office of Science and Technology. August 2003. Developing Water Quality Criteria for Suspended and Bedded Sediments (SABS) – Potential Approaches. Available on the EPA website at: http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/pollutants/sediment/

- Combination/Synthesis of Above Approaches

EPA completed a framework for Developing SABS water quality criteria in 2006.[11] Additionally a potential conditional probability approach for sediment criteria development was presented by EPA in its guidance on Using Stressor-response Relationships to Derive Numeric Nutrient Criteria (EPA-820-S-10-001, November 2010). The draft guidance was subject to SAB review in 2010. In that review, the SAB noted that before any regression-type approaches are used for criteria development, a cause-and-effect link should be established between the stressor (i.e., SABS or TSS) and the use impairment. In addition, uncertainty associated with such relationships needs to be quantified and the influence of significant mitigating factors on use impairment should be evaluated.

2.3 State Approaches

Most states do not have specific criteria for SABS, and sediment-related impairments are often addressed through narrative water quality standards. However, there are many state criteria for turbidity, a closely related measurement (see EPA Appendix 3 Sediment Related Criteria for Surface Water Quality. www.water.epa.gov/scitech/swguidance/standards). The application of the available criteria can be considered through a review of TSS and turbidity TMDLs. Examples of two TMDLs for SABS are reviewed below to present examples of some different approaches used to address sediment-related use impairments.

2.3.1 Kansas – Lower Arkansas River Basin TMDL

The Kansas narrative water quality standards provide that "Suspended solids added to surface waters by artificial sources shall not interfere with the behavior, reproduction, physical habitat or other factor related to the survival and propagation of aquatic or semi-aquatic or terrestrial wildlife. (KAR 28-16-28e(c)(2)(D))." The Lower Arkansas River Basin was identified as sediment-impaired based on biological monitoring, with an average TSS concentration of 127 mg/L. Decreased loads should result in aquatic community improvements. Consequently a goal was set to reduce the average TSS to below 100 mg/L most of the time, corresponding to a 20% reduction from current loads. Since the majority of the load has been determined to come from non-point sources, TMDL implementation targeted agricultural BMPs.

2.3.2 Pennsylvania – Indian Creek Watershed TMDL

The Pennsylvania narrative water quality standards provide that "Water may not contain substances attributable to point or nonpoint source discharges in concentration or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant or aquatic life. (25 PA Code 93.6(a and b))." Indian Creek was placed on the 1996 303(d) list of impaired water bodies for not meeting the designated aquatic life use due to various pollutants, including siltation; EPA Region 3 prepared a TMDL for siltation in 2008. EPA used the "reference watershed" approach to develop allowable sediment loading rates to protect the designated uses of Indian Creek. The reference watershed approach determines the sediment

[11] Framework for Developing Suspended and Bedded Sediments (SABS) Water Quality Criteria EPA-822-R-06-001 May, 2006

loading rate for an unimpaired watershed with similar physical characteristics to the impaired watershed. "The objective of this process is to reduce the loading rate of sediment in the impaired stream segment to a level equivalent to or slightly lower than the loading rate in the unimpaired reference stream segment. Achieving the sediment loadings set forth in the TMDLs will ensure that the designated aquatic life of the impaired stream is achieved." Based on this comparison, the TMDL called for a 95% reduction in the existing sediment load.

Although numeric criteria have not been developed for SABS, certain mechanisms of use impairment caused by SABS are understood (e.g., effects on aquatic organisms or habitat loss), and use impairments due to SABS are common. Consequently, it is appropriate to implement adaptive management practices to restore designated uses in water bodies.

3. RECOMMENDATIONS

The Models and Standards subgroup supports several recommendations made by the 2004, 2010 and 2011 Science Advisory Boards on models and methodology used in the development of water quality nutrient and SABS criteria and the methods used in the derivation of numeric standards. We have included some of these in our list of recommendations below:

<u>Assure that nutrient/SABS criteria and standards reflect a specific and science-based cause-effect relationship.</u>

- Development of nutrient and SABS criteria should be based on a transparent and science-based demonstration that one or more of these factors is causing an adverse biological effect on the designated use for the water body.
- Additional guidance should be developed on SABS (including TSS and turbidity) criteria using biological endpoints related to the impairment of designated uses in different water body classes.

<u>Calibrate the models and data appropriately to the size and class of the watershed and its designated use.</u>

- In many cases, there are limited monitoring data available for use in watershed modeling. Thus, it is often hard to find sufficient quality data to 1) give flow, nutrient and sediment concentrations on which a model can be calibrated, 2) adjust the model so that it best reflects the measured values, and 3) test the model against a different time period of monitoring data, to assess performance. For example, monitoring data for an 8-digit HUC watershed used to calibrate a model might be inappropriately used to estimate discharge from smaller 12-digit sub-watersheds for area prioritization. As models are used more frequently and over wider areas, this misuse is becoming more of a concern.
- Additional guidance should be developed to identify and characterize the important factors influencing the interactions between nutrients or SABS and cultural eutrophication in different water body classes including man-made channels such as drainage ditches.

Follow a weight of evidence approach to establishing criteria[12].

- Data, methods and models used to develop criteria and establish numeric standards should not rely solely on the reference condition or any other single approach, but instead should be based on the broader weight of evidence.
- Weight of evidence approaches should evaluate and document uncertainties in the data, models and methods as well as environmental factors in the water body that can change the impact of the stressors on impairment of the designated use (e.g. water color, depth). Such an approach will assure informed mitigation management decisions can be made and the body of water can be restored to its designated use.

Identify and quantify the effectiveness of agricultural BMPs.

- Identify and quantify the effectiveness of BMPs and emerging technologies being employed on farms and ranches to reduce agricultural nutrient and SABS loads to achieve water quality goals.
- Consider "certainty mechanisms" that encourage farmers and ranchers to implement approved voluntary resource conservation practices by providing them safe harbor in further regulatory action.

Apply Downstream Protection Values (DPVs) only when there is impairment downstream.

- DPVs should be applied when rigorous analyses show that mitigation practices in upstream watersheds can help restore the designated use of the downstream water.

Use adaptive management as a primary management tool.

- When criteria and numeric standards are developed using the best available science and they connect levels of nutrients or TSS to an unreasonable adverse effect or impairment of the designated use for a body of water, adaptive management practices should be implemented and the standards enforced.
- In instances where numeric criteria have not been developed and the designated use of the water body is impaired due to levels of nutrients and/or SABS, loads should be reduced according to a schedule over time and a protocol developed on how to measure improvements in water quality.
- Use CEAP studies to identify and quantify the effectiveness of BMPs and emerging technologies being employed on farms and ranches to reduce agricultural nutrient and SABS loads.
- Partner with NRCS to link CEAP studies to 303(d) lists to help identify vulnerable lands in watersheds.

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[12] From EPA's 2011 Final Guidance on EDSP Weight of Evidence Evaluations, page 27: "Generally, WoE is defined as the process for characterizing the extent to which the available data support a hypothesis that an agent causes a particular effect. A WoE assessment explains the kinds of data available, how they were selected and evaluated, and how the different lines of evidence fit together in drawing conclusions. The significant issues, strengths, and limitations of the data and the uncertainties that deserve serious consideration are presented, and the major points of interpretation highlighted."

See also the 2010 SABS report on Empirical Approaches to Nutrient Criteria Derivation Guidance and the EPA 2006 report on the Data Quality Objectives Process for additional information on weight of evidence and uncertainty analyses.

- Partner with NRCS and FSA to help target USDA conservation programs for water quality improvement.
- Provide guidance to USDA and land grant institutions on EPA priorities for additional research on BMPs. New technologies and new varieties with improved nutrient use efficiency are critical to improving on-farm efficiencies.

Fund, conduct and incorporate additional research.

- Research should examine the overall costs associated with load reduction in comparison with both the benefits of water quality improvements and the benefits of agricultural land use. Cost and benefit analyses, including farm-level impacts, should be conducted on regulatory approaches and mandates to achieve water quality goals.
- Additional research on BMPs, new technologies and new varieties with improved nutrient use efficiency is critical to improving on-farm efficiencies.

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Attachment A

Draft Background Information
Nutrient and SABS Criteria

Date	Action
Pre 2000	TMDLs address nutrient concerns through mechanistic modeling to ensure compliance with Dissolved Oxygen water quality standard. Example: Long Island Sound TMDL limits on nitrogen.
1998	EPA publishes Guidelines for Ecological Risk Assessment (May, 1998) and National Strategy for the Development of Regional Nutrient Criteria (June, 1998).
2000	EPA publishes Guidance Documents on development of numeric nutrient criteria for rivers and streams and lakes and reservoirs. EPA presents the statistical distribution method as a valid approach to nutrient criteria development. EPA subsequently issues Eco-Regional criteria documents using distribution approach.
June 2001	External Expert Peer Review Comments on Draft Ecoregional Nutrient Criteria Documents. The Experts comment that "Reference conditions alone cannot be used to derive criteria. Need to use the 'weight of evidence approach' which addresses all the key elements of nutrient criterion development."
August 2003	EPA releases DRAFT Potential Approaches for "Developing Water Quality Criteria for Suspended and Bedded Sediments."
February 2004	SAB issues Notification of a Consultation regarding its review of EPA's Draft Potential Approaches for developing sediment criteria.
May 2006	EPA publishes "Framework for Developing Suspended and Bedded Sediments (SABS) Water Quality Criteria."
May–July 2007	EPA issues memorandum urging states to accelerate promulgation of numeric nutrient criteria; ASIWPCA replies that states are failing to find a strong linkage between nutrients and use impairments.
June 2008	EPA Region 3 issues five nutrient TMDLs in Pennsylvania, applying phosphorus endpoints developed using Weight of Evidence Approach. TMDLs challenged and SAB review of stressor-response relationships initiated.
January 2009	EPA issues letter of determination to Florida declaring necessity of numeric nutrient criteria.
January 2010	EPA proposes numeric nutrient criteria for Florida lakes and streams. Lake criteria use simple regressions based on meeting target chlorophyll-a concentrations. Stream criteria based on statistical distributions without consideration for use impairment. Criteria are independently applicable.
April 2010	SAB issues final report on proposed EPA Guidance on the use of Stressor-Response Relationships to derive numeric nutrient criteria. Must show causation.
November 2010	EPA finalizes Guidance on Using Stressor-response Relationships to Derive Numeric Nutrient Criteria. Final Florida numeric nutrient criteria promulgated.
March 2011	EPA announces plans to develop Permit Writers Guide for Implementing Nutrient Criteria – implements numeric limits from State Narrative Standards.
March 2011	EPA response to New England Interstate Water Pollution Control Commission: EPA reasserts "independent applicability" approach.
March 2011	Nancy Stoner Memorandum to EPA Regional Administrators: Framework for State Nutrient Reductions. Memorandum presents approach for reducing nutrient loads prior to criteria development. Focus on point source reductions and agricultural BMPs.
June 2011	EPA issues Interim Draft "Technical Assistance for Developing Nutrient Site-Specific Alternative Criteria in Florida."
June 2011	House Subcommittee on Water Resources and Environment issues memorandum: Running Roughshod Over States and Stakeholders: EPA's Nutrients Policies.
July 2011	SAB issues "Review of EPA's draft Approaches for Deriving Numeric Nutrient Criteria for Florida's Estuaries, Coastal Waters, and Southern Inland Flowing Waters." The SAB highlights EPA's approach to criteria development regarding the use of one, two or all three approaches. It notes: "There would be a greater confidence in the criteria if multiple approaches were applied to each of the systems for which data and models are available."

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Attachment B

Aquatic Plant Growth and Dissolved Oxygen Relationships

1. INTRODUCTION

Aquatic plants include phytoplankton (free living, single-celled algae), periphyton (algae and diatoms attached to hard surfaces such as rocks) and rooted vascular plants (macrophytes, typically in shallow waters). Phytoplankton typically predominates in slow-moving waters (lakes and rivers), while periphyton predominates in shallow streams where light penetrates to the bottom.

Aquatic plants affect designated uses in receiving waters through several mechanisms. These plants increase the amount of dissolved oxygen in a water body through photosynthesis, and they decrease dissolved oxygen (DO) through respiration (living) and decay (death). Respiration may cause diurnal DO levels to fall below a state's acute water quality standards, while the average DO remains above the chronic standard. When aquatic plants die, their decay may cause the DO to fall below the chronic standard.

Excessive plant growth may also impair aquatic life designated uses due to habitat alteration and changes in species abundance, which may affect food supplies for aquatic animals. Excessive plant growth also affects recreational uses of receiving waters through aesthetics (e.g., color).

2. INTERRELATIONSHIP BETWEEN PLANT GROWTH AND DO

The interrelationship between plant growth and DO in streams, lakes and estuaries is extremely complex [See Eutrophication Kinetics from WASP Version 7 model below; from WASP7 Benthic Algae – Model Theory and User's Guide (EPA 600/R-06/106), Figure 2]. As illustrated, inorganic nutrients support the growth of phytoplankton and periphyton. This growth is modulated by many other factors. In addition to nutrients (nitrogen, phosphorus), phytoplankton also requires light, carbon and other micro-nutrients (e.g., silicon) to grow, and this growth is offset by predation (grazing) and death (settling). Light limitation in lakes and large rivers may occur due to water color, turbidity and self-shading as phytoplankton populations increase.

Periphyton growth is affected by these factors and many others. A Periphyton community includes different plant species (algae, diatoms), each competing for resources. Periphyton grows on rocks, and growth can be limited by the amount of available substrate, and there is typically a maximum density for attached plants. Light limitation may occur due to shading by trees, and SABS and periphyton are subject to scour during high flow conditions.

Phytoplankton and periphyton influence DO by adding oxygen to the water column during photosynthesis and consuming DO via respiration and decay (death). The net effect of these processes on ambient DO is under the control of many other factors that influence re-aeration with the atmosphere (the primary source of oxygen). In lakes, re-aeration is driven by wind and stratification. In streams, it is controlled by water depth and turbulence. Consequently, elevated levels of plant growth may show no impact on dissolved oxygen in one setting (particularly streams), while lower levels of plant growth may increase the possibility of DO standard exceedances in another.

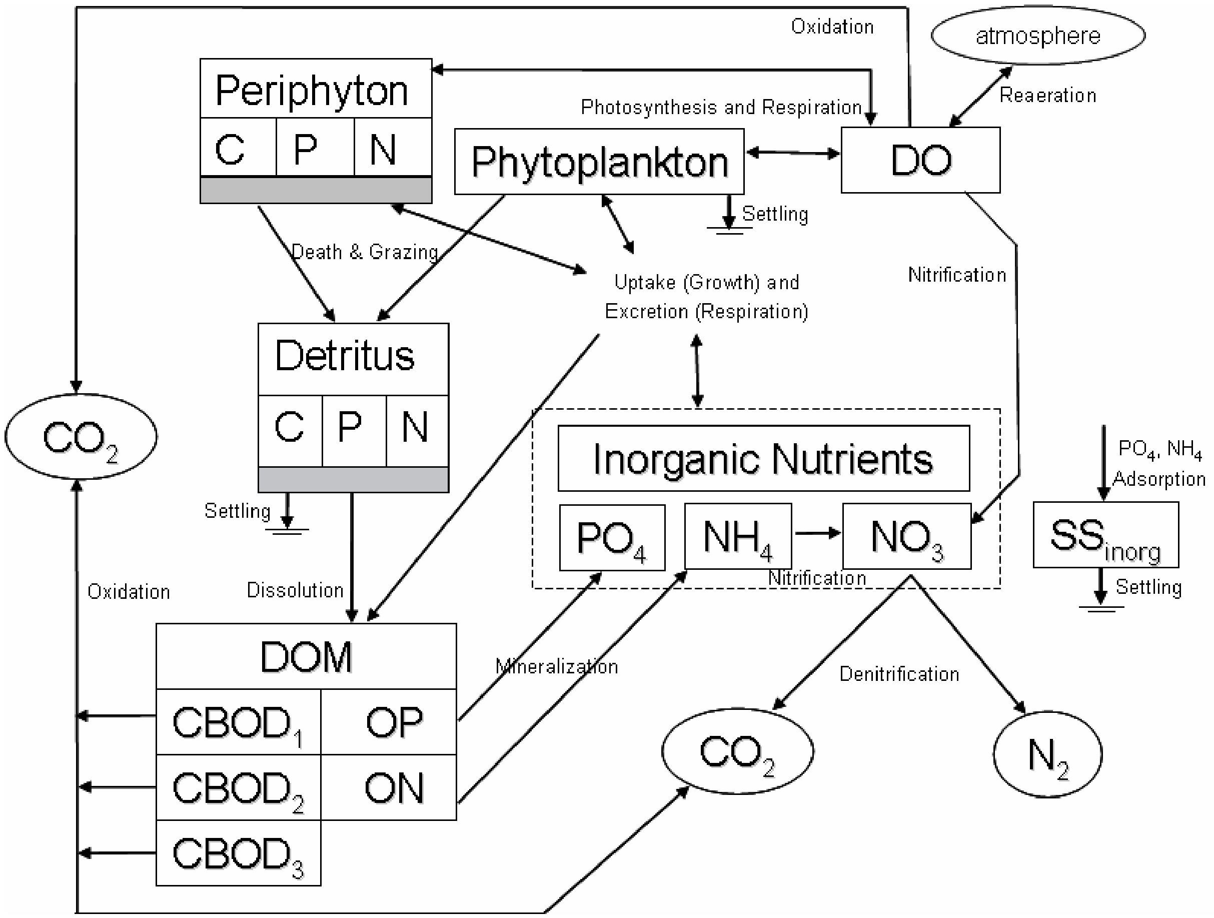


Figure 2 from WASP Version 7.

3. EXAMPLES FOR LAKES

When the State of Minnesota evaluated the relationship between dissolved oxygen concentration in the hypolimnion in comparison with total phosphorus (TP) levels in the epilimnion of reference lakes with limited human disturbance[13], the MPCA reported the following:

Epilimnion TP Concentration	Lake Classification – Hypolimnion DO Concentration
<10 µg/L (estimated)	≥ 5.0 mg/L (none observed in 74 reference lakes)
13- 27 µg/L	> 1.0 mg/L throughout hypolimnion (6 lakes)
15- 40 µg/L	< 1.0 mg/L somewhere in hypolimnion, but not everywhere
14- 160 µg/L	< 1.0 mg/L throughout the hypolimnion

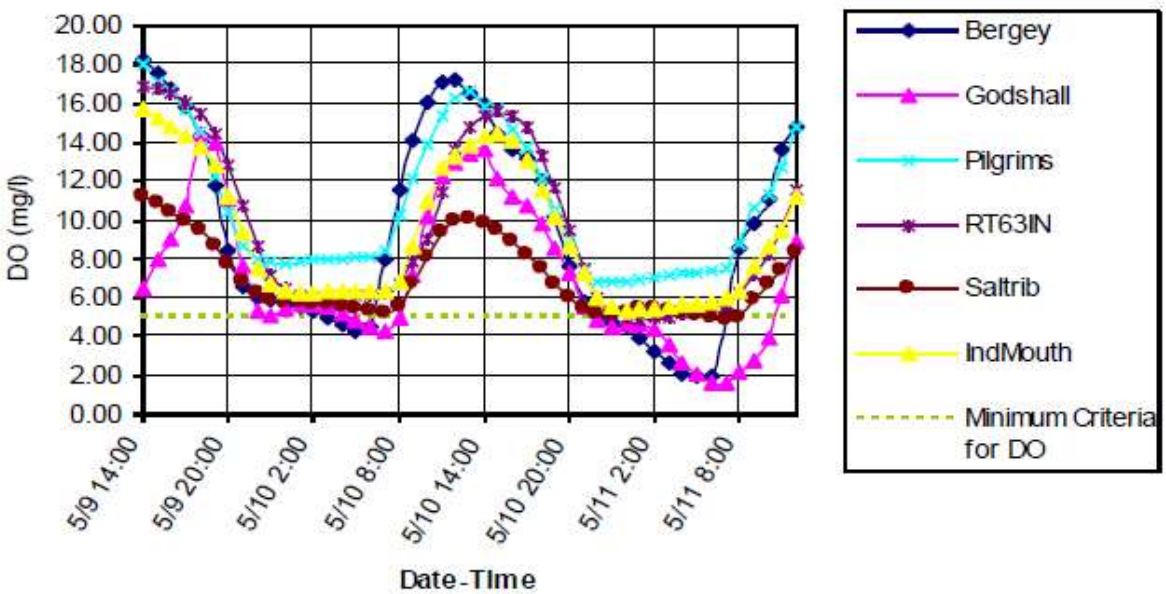
These data illustrate the range in TP concentration associated with hypolimnic DO concentration during the critical summer period (typically August). TP concentration is assumed responsible for lake algal concentration. The algal concentrations associated with these observations were not reported. However, the

[13] Minnesota Lake Water Quality Assessment Report: Developing Nutrient Criteria. Third Edition. September 2005. Available online at: http://www.pca.state.mn.us/index.php/view-document.html?gid=6503.

interquartile range (25th-75th percentile) of mean chlorophyll-a for the reference lake database was reported as 4-22 µg/L. These data indicate that relatively low levels of chlorophyll-a and TP can result in significant oxygen depletion in stratified lakes. Only stratified lakes with exceedingly low levels of chlorophyll-a could be expected to maintain dissolved oxygen levels in excess of 5.0 mg/L throughout the summer.

4. EXAMPLES FOR STREAMS

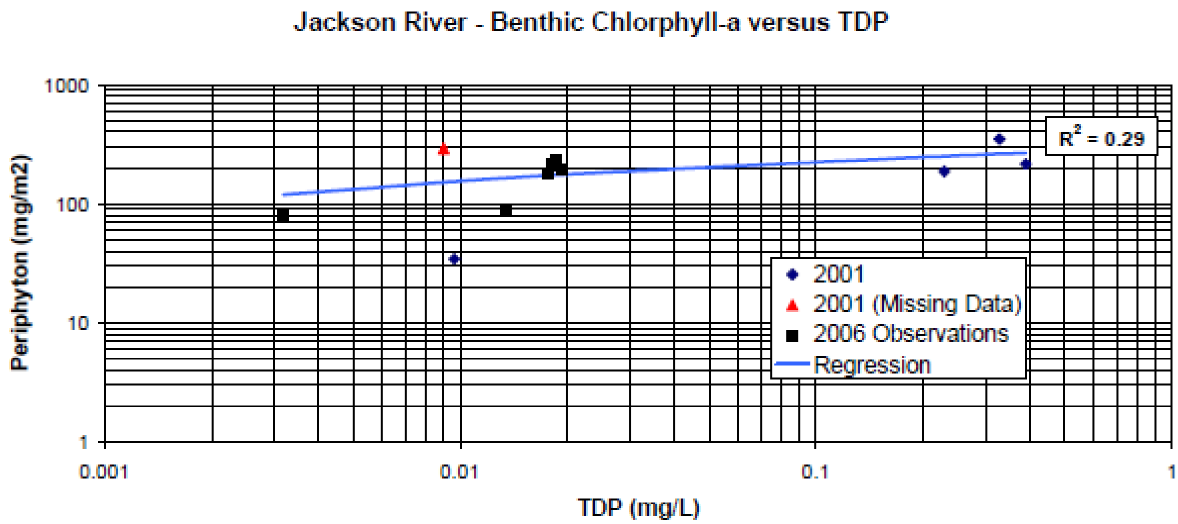
It is exceedingly difficult to relate nutrients to plant growth to dissolved oxygen concentration in streams due to the many other factors that influence this relationship. For example, consider the diurnal dissolved oxygen concentrations reported for Indian Creek:[14]



This example illustrates photosynthetic DO increases during the daylight hours, followed by respiration-induced DO decreases at night. However, while some stations see relatively low DO levels approaching 2.0 mg/L (e.g., Bergey), other stations do not fall below about 7.0 mg/L (e.g., Pilgrims). The periphyton levels responsible for the observed diurnal DO variability were not reported.

The relationship between nutrient load, periphyton growth and dissolved oxygen is difficult to model because periphyton represents a community of competing plant species, and the available models do not adequately represent this. Moreover, because periphyton remains in one place and the stream flow bathes it with the available nutrients, impressive periphyton biomass can develop in response to very low levels of nutrients (Dodds, 2006), depending upon the time interval between scouring events. Data for the Jackson River in Virginia illustrate this fact. Periphyton concentrations ranged from 200-300 mg chl-a/m^2 when total dissolved phosphorus exceeded 0.2 mg/L. Following implementation of phosphorus controls reducing TDP to < 0.02 mg/L, periphyton levels remained at 200 mg chl-a/m^2. The dissolved oxygen level associated with this biomass of periphyton in this river ranged from about 6 to 12 mg/L. The lowest periphyton concentrations, above the discharge, ranged between 35-80 mg/m^2.

[14] Nutrient and Sediment TMDLs for the Indian Creek Watershed, PA. EPA Region 3. 2008.



The threshold levels of periphyton associated with aesthetic use impairments (e.g., 100-150 mg chl-a per square meter) are not associated with low DO or adverse effects on benthic macroinvertebrates (Welch et al., 1988).

SUMMARY

As discussed above, the relationship between plant growth and dissolved oxygen in lakes and streams is complex. Relatively low levels of phytoplankton are sufficient to cause low dissolved oxygen levels in stratified lakes. In streams, elevated levels of periphyton have not been attributed to violations of the DO standard up to the level being considered for aesthetic impairment. In these systems, aesthetic thresholds are being used to define use impairment. The table below summarizes the impairment thresholds in relation to the available information on DO impacts.

Parameter	Oligotrophic Lakes	Mesotrophic Lakes	Streams
Unimpaired	<2 µg chl-a/L	<10 µg chl-a/L	<50 mg chl-a/m^2
Impairment Threshold (type)	~ 4 µg chl-a/L (aquatic life)	~20 µg chl-a/L (aquatic life)	~150 mg chl-a/m^2 (aesthetic)
Habitat Type	Cold Water fishery	Warm Water fishery	All
DO status	Meets 5.0 mg/L in hypolimnion	Concentration < 1.0 mg/L somewhere in hypolimnion	Generally meets 5.0 mg/L

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Appendix B
Economics Subgroup Report

The role of economic analysis in water policy provides opportunities to estimate actual and potential benefits and costs of an array of relevant alternative solutions and their respective likely consequences. When applied correctly with objectivity and sound scientific methods, this approach allows the scientist to remain outside the political decision making that follows. While water quality is a hydro-biologic concept, with human activity, water quality cannot be achieved, maintained, monitored or improved without financial resources. Thus, inclusion of economic benefits and costs is essential to scientific research, analysis, implementation, assessment and review.

The typical method that is used is some form of benefit-cost analysis (BCA), sometimes also referred to as cost-benefit analysis (CBA). It is as straightforward as it is complex. All known benefits and costs are measured or estimated. Benefits net of costs are determined. Net benefits of each alternative are compared to the status quo. Thus, a BCA is simple yet elegant in comparison of solutions that can inform decision makers of the costs (and benefits) these policies may impose on (offer to) those stakeholders directly or indirectly impacted by policy.

Identifying and Characterizing the Problem

The following issues impact the reliability and relevance of economic analyses to the policy making process: 1) existence and use of consistent guidelines for economic analyses, 2) timing and triggering of economic analyses, 3) expertise and other collaborative requirements and 4) scientific peer review.

Our investigation included discussions with agricultural economists and administrative personnel at EPA, two USDA agencies, and four land grant universities as well as review of current EPA standards for economic analysis and review of water policy-relevant economic analyses conducted by USDA agencies. Based on this investigation we have identified strengths and weaknesses in current approaches and offer recommendations on improving the reliability and relevancy of economic analyses for water policy.

Issue 1 - Knowledge and Use of EPA Guidelines

The EPA has developed a relatively thorough set of procedures and guidelines that have evolved over time. The most current document entitled *Guidelines for Preparing Economic Analysis*, (referred to as *Guidelines* henceforth) was released in December 2010. *Guidelines* addresses concepts related to analyses targeted to different stakeholder groups and includes: 1) an examination of net social benefits using BCA, 2) the examination of impacts on industry, governments, and non-profit organizations using an economic impacts analysis (EIA); and the examination of effects on various sub-populations, particularly low-income, minority, and children, using distributional analyses (U.S.EPA, 2010). This set of guidelines is now the standard by which EPA economic analysis is conducted. Theoretical and methodological considerations (including transparency of assumptions and analysis boundaries, estimation of benefits and costs, social discounting (net present value) calculations, modeling, risk and uncertainty) are discussed in detail and tied to EPA policy examples.

EPA personnel suggest that there is a general awareness and adoption of these guidelines – not only by Agency economists, but by contractors, economists from other government agencies and academic economists as well (Nathalie B. Simon, Associate Director, National Center for Environmental Economics, EPA, personal communication, August 2011). Our informal discussions with USDA and land grant economists support this assertion.

Importantly the guidelines address the need for transparency related to assumptions used, data source and relevance as well as potential limitations of scope and scale in the analyses. However, the guidelines offer few remedies to overcome shortcomings. Some of these issues are discussed further below.

Issue 2 - Requirement and Timing of Economic Analysis in Policy Making

Economic analyses are required under Executive Order 12866 for all economically significant regulatory actions (i.e., those expected to have an economic impact of $100 million or more). This Executive Order was set in 1993 as part of an effort to improve the efficiency of the regulatory process. Other statutes address the need to conduct economic analyses when regulatory actions can have large impacts on specific groups (such as children, minorities, and local governments). Statutes also signal instances when economic analyses are required (e.g., impact on children, impact on small businesses or local governments). While it is understood that time and resources may limit the scope of analysis, the $100 million floor entirely misses the point that rural economies and the potential impacts can be much less than that and that while statutes address small businesses, the impact to one type of business may be small, yet still be significant in the life of the community and its residents. There need to be procedures in place to account for such impacts. For example, limited funds may be redirected to cost-share with willing states of affected rural areas.

Issue 3 - Expertise and Other Collaborative Requirements for Economic Analyses

Economic analysts are not typically imbued with the knowledge of the multitude of physical scientists required in EPA-related projects, such as engineers, environmental scientists, hydrologists, geologists, physicists, chemists, medical scientists, soil scientists, agronomists, ichthyologists, limnologists, etc. Nor do economic analysts always possess the skills of other social scientists such as cultural anthropologists, sociologists, demographers, historians, political scientists, etc. EPA has the opportunity to tap into a vast array of experts in federal and state agencies, land grants and non-governmental organizations, in formal and informal ways. Our informal surveys of land-grant, EPA, USDA NRCS and USDA ERS personnel suggest this occurs, but not routinely.

Additionally, it is unclear how much information from other government agencies is incorporated into EPA research. Institutional cultures, legal roles, and personalities can discourage joint work on a meaningful level. EPA in a regulatory role sees the world in a very different way than, for example, Farm Service Agency (FSA) or the Natural Resource Conservation Service (NRCS) or state extension services in program assistance and educational roles do. These philosophical and legal differences seem to hinder cooperation on scientific research. Whether this is a conscious decision based on perceptions of purpose, or an unintended consequence or a funding issue is not clear.

Nutrient management is an issue that would seem to lend itself to many cooperative endeavors, especially with respect to scientific research and experimentation, and especially for farm-level insights on impacts, and incorporation of farm bill conservation programs to mitigate both regulation and environmental damage. Economic research on farm-level impacts of BMPs adopted in response to proposed EPA regulations exists, but these analyses are not necessarily commissioned by EPA in anticipation of regulatory actions. For example, as stated by Ribaudo et al. (2003) in *Manure Management for Water Quality. Costs of Animal Feeding Operations of Applying Manure Nutrients to Land*:

> *"While motivated by Federal policy provisions first proposed in 1999, our study is not intended as a direct examination of either EPA's new CAFO regulations or USDA's nutrient management policies.*

Rather, the study provides an independent analysis of a key provision of these and other Federal and State animal waste initiatives—the land application of manure at agronomic rates."

In fact, no evidence could be found that anything more than information sharing had taken place among the agencies.[15] The potential for joint efforts and efficiency gains suggests administrative focus for improvements.

But such knowledge and more may be crucial for the economic analysts to form meaningful assumptions, select appropriate methodologies, determine and collect pertinent data, conduct efficacious analysis, provide relevant interpretation, and deliver the results in useful bites to the various publics who need it. How such expertise flows into economic analysis must also follow the strictures of objectivity and sound science. It is not clear how this process of interdisciplinary team-building occurs, although it does seem to be evident in their studies. Perhaps the Guidelines should include such guidance.

Issue 4 – Peer Review

Federal analysts often participate in a review process either internal to their agency or through the US Government Accountability Office. However, internal reviews are not often made public and reviews of economic analyses that influence policy may not be completed until after the policy has been enacted.

Where EPA findings from research are found unacceptable to those targeted in a problem area, there are many cases of counter studies being conducted to either disprove EPA conclusions or suggest alternative solutions to regulatory efforts. The recent rebuttal by Florida agricultural stakeholders and others to EPA and Florida Department of Environmental Protection economic analyses on cost of implementation of current proposed standards is one such example.[16] However, the robustness of these counter-analyses may also be scrutinized without evidence of a satisfactory scientific peer review.

The *Guidelines* acknowledge the importance of the Science Advisory Board (SAB) by providing examples throughout where economic estimation techniques, and numerical values associated with discount rates and risk were vetted through the SAB. However, nowhere in the document is guidance offered regarding the need, timing, scope and source of a peer review process for all EPA economic analyses. The Guidance document would benefit from such an addition. Similarly, economic analyses conducted in response to those done by EPA should be subjected to the same peer review process.

EPA research can benefit from increased focus on framing of the issue(s). Scope and objectives of the studies and the targeted problem also affect the framing of the research question and methodology used. These considerations are addressed in part in Chapter 5 of the *Guidelines* which notes the importance of scope. There are numerous economic studies, for example, that attempt to answer the question of site-specific cost-effectiveness of practices. However, even a practice that is not cost-effective for a specific problem may have ancillary benefits that would justify its use. Such examples, depending on the situation, may include continuous no till, conservation cover crops, and drainage management. Again, depending on the objectives and location dynamics, there may be indicators other than cost-effectiveness to determine whether a practice or system is

[15] Some joint activities, such as those organized by the Council for Environmental Quality, provide opportunities for agencies to interact and share scientific information and discuss issues of mutual interest. For example, NRCS, through program management and oversight, has information on ways to reduce nutrient loading, especially at the farm level.
[16] Economic Analysis of the Proposed Federal Numeric Nutrient Criteria for Florida, prepared for Florida Water Quality Coalition by Cardno Entrix, November 2010.

commendable for a site because it does not generally take into account the array of benefits that accrue from conservation measures. A more complex model is often needed to quantify these benefits. Such model design and analysis often requires an interdisciplinary team of scientists, including soil scientists and natural resource and agricultural economists.[17]

EPA needs to recognize that ethics are embedded in scientific research. The ethics of science may come into economic analysis intentionally or unintentionally. The analysts would identify prior to analysis the standards of the study, self-bias and potential for unintended consequences of the study process. Examples of an ethical code might include submitting to the alternatives/consequences approach for policy questions, identifying and setting aside one's own beliefs and agendas, finding and using the best data and science available, conducting sensitivity analysis on critical parameters such as the discount rate, project life, costs of implementation, valuation of non-market benefits and costs, human behavioral response, regulatory oversight, weather and climate, etc.

[17] Discussions with Andy Manale, EPA, contributed to this explanation and background.

Appendix C
Communications Subgroup Report

Table C1. Sources of Information Used in Communicating Science Issues Related to Environmental Quality

Stakeholder	Strengths	Weaknesses
Federal agencies	*Technical assistance through Farm Bill programs* *Cost-share assistance through Farm Bill programs*	*Staffing deficits* *Program funding* *Paperwork* *Historically very short/impractical timeframes to enroll in programs* *Many farmers and ranchers not familiar with NRCS* *Perception that NRCS is a regulatory agency* *Bureaucratic, little time for field work*
State agencies	*Some states have very good data on water quality* *Some states willing to make data available*	*Not all states have a state water agency or similar framework* *Not all states have adequate water quality data* *Some states reluctant or unwilling to make data available* *Insufficient staffing* *Staff not familiar with agriculture*
Conservation districts	*Some state-based entities have local offices* *Some states have CDs and work in partnership with NRCS*	*Staffing deficits* *Program funding/consolidation challenges* *Paperwork burden* *Effectiveness varies by state and within states*
Independent consultants	*Personal relationships with farmers and ranchers* *Knowledge of local production systems* *Good information on costs and benefits of changing practices* *Considered trusted advisors* *Local credibility*	*Potential bias for particular technologies* *Perception of conflict of interest (e.g. sales)* *Focus is on costs and productivity versus environmental performance*
Seed, fertilizer, chemical and equipment manufacturers	*Personal relationships with farmers and ranchers* *Knowledge of local production systems* *Good information on costs and benefits of changing practices* *Considered trusted advisors* *Local credibility* *Resources to demonstrate practices and products* *Regional and statewide influence* *Aware of changes in regulations*	*Potential bias for particular technologies* *Perception of conflict of interest (e.g. sales)* *Focus is on costs and productivity versus environmental performance*
Commodity groups	*Credibility with farmers and ranchers* *Knowledge of production systems and regional issues* *Many good established programs for farmer-to-farmer demonstration*	*Credibility may not be good with all stakeholders* *Staffing issues*
Land grant universities and extension	*Credibility with farmers and ranchers* *Knowledge of production systems and regional issues* *Many good established programs for farmer-to-farmer demonstration*	*Credibility may not be good with all stakeholders* *Staffing issues* *Funding of programs*
Non-government organizations	*Most farmers and ranchers belong to some type of member organization* *Technical expertise on local and regional production systems* *Private funding* *Diversity of organizations and locations* *Trusted by membership*	*Some groups are more politically oriented rather that technically oriented* *Diversity may lead to disagreement on approaches* *Groups might be viewed as biased by regulatory agencies or other NGOs* *Staffing issues*
Individual farmers and ranchers	*Credibility* *Experience* *Can "translate" scientific terminology so it is easily understood by peers* *Early adopters will be leaders*	*May lack training, time and financial ability* *Resistant to change*

Examples of Successful Environmental Quality Projects with Strong Communications Components

The following programs are good examples of effective water quality programs and communications programs. They share many common elements: science-based information, collaborative approaches to address water quality concerns, dissemination of information through credible/local experts, and the flexibility to adjust as new data or practices are developed.

The Clean Water Farm - River Friendly Farm Project (CWF-RFFP) is a project of the Kansas Rural Center, administered by the Kansas Department of Health and the Environment and has been funded in part by U.S. EPA Non-point Source Section 319 Program Funds. Participating farmers complete the environmental self-assessment for their own farm with assistance from KRC staff. A strength of this program is the farmer-generated self-assessment to develop an action plan that protects or improves water quality on his/her own farm. www.kansasruralcenter.org/CWFP.html

Coalition for Urban Rural Environmental Stewardship - Water quality coalitions have been formed throughout the Central Valley in response to Conditional Waiver of Waste Discharge Requirements passed in 2003. The Central Valley Regional Water Quality Control Board (Regional Board) administers the regulatory program, which has been modified since its inception and is currently named the Irrigated Lands Regulatory Program (ILRP). Viewed by many as the most economical way to comply with the regulations, the coalitions' goal is to represent farmers with irrigated cropland within a regional watershed. The success of this program is that it has been locally driven and has taken a proactive approach to avoid regulations. www.curesworks.org/coalitions.asp

Sustainable Conservation Best Management Practices for California Dairy Regulations Project provides practical, effective and economic options which are researched and developed to help dairy farmers apply manure nutrients in precise amounts, and at the right time in their crop's growth cycle. The project provides technical support to help farmers get funding and other resources needed to implement effective solutions. www.suscon.org/dairies/BMPChallenge.php

Practical Farmers of Iowa - A diverse organization that advances profitable, ecologically sound, and community-enhancing approaches to agriculture through farmer-led investigation and information sharing. PFI members are encouraged to become Farmer Cooperators in a wide array of projects that examine diverse cropping systems in Iowa and neighboring states. An ongoing project is the effect of different cover crop regimes on cash crop yields. In Iowa, cover crops planted after the harvest of the cash crops corn and soybeans can retain nitrogen and soil on the farm. This project has the benefit of evaluating the effects of cover crop use over a period of 5-years on the farms of cooperating farmers and incorporating economic information into recommendations. It provides estimates of nitrogen and soil retention with the use of a cover crop as well as critical information about the effects on the yields of cash crops. www.practicalfarmers.org

Maryland Grazers' Network - A partnership supported through the Chesapeake Bay Foundation, Future Harvest, NRCS, and the Maryland Cooperative Extension Service. Grazers worked with this partnership to develop the Maryland Grazers' Network. The project assists farmers with workshops and other technical assistance in establishing grass-based dairies and other pasture-based farming systems that can reduce both water pollution and input costs to the farmer. The Network partners new and experienced grazers directly through farmer mentorships and engages the assistance of technical specialists working with local conservation districts, the Maryland Department of Agriculture (MDA), and NRCS staff.
www.md.nrcs.usda.gov/news/newsreleases/2009/nrgrazers.html

Phosphorus Fertilizer Inputs Project for Field Corn in New York, a USDA Sustainable Agriculture Research & Education Program (SARE) Project - This highly successful program supported many locally led partnerships and clearly demonstrated economic benefits for famers. Cornell University researchers and educators used the trials to demonstrate that growers could get customary yields with little or no phosphorus applications when planting corn in soil that already tests high for the nutrient. The project yielded such convincing data and involved such a large number of stakeholders—including growers, consultants, educators and scientists—that it led almost instantly to widespread changes in behavior.
www.nmsp.cals.cornell.edu/projects/starterP/FinalReport.pdf