Mississippi Upland Nutrient Reduction Strategic Plan

March 30, 2011

Mississippi Upland Nutrient
Reduction Strategic Plan

Prepared for

Mississippi Department of Environmental Quality
PO Box 2261
Jackson, Mississippi 39225-2261

Prepared by

FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, AR 72211

FTN No. 3120-720

March 30, 2011

EXECUTIVE SUMMARY

The Mississippi River/Gulf of Mexico Hypoxia Task Force, as well as the Gulf of Mexico Alliance, have issued Action Plans to reduce the size of the Gulf hypoxic zone by reducing excess nutrient loadings to the Gulf of Mexico. Each of these Action Plans calls for the development and implementation of state nutrient reduction strategies. Mississippi has been a leader in the development and implementation of state regional nutrient reduction strategies, first for the Delta region, and subsequently for the Upland region. The regional strategies permit consistent, compatible, and coordinated watershed management plans to be developed and implemented across the state while addressing the distinct regional differences that exist for nutrient sources across the state.

The Upland Nutrient Reduction Strategic Plan is focused on answering four questions:

1. What levels of nutrient reduction are achievable and by when?
2. What will they cost?
3. What is the value to each stakeholder from these nutrient reductions?
4. What levels of nutrient reduction will protect state waterbodies and benefit the Gulf of Mexico?

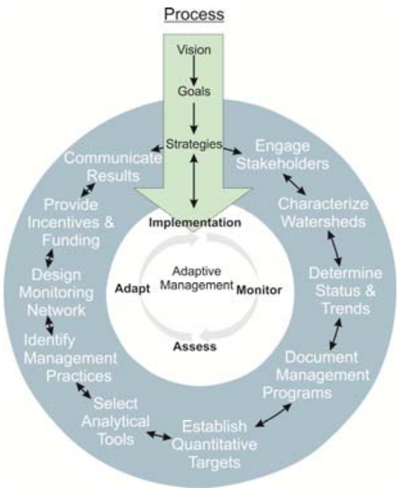

Figure ES. 1.

The process of developing and implementing a nutrient reduction strategic plan begins with a vision (Figure ES. 1). A compelling picture of how nutrient reduction will improve the quality of life on the Mississippi coast – environmentally, economically, and socially. The questions listed above can be rephrased as goals whose attainment will answer these questions (e.g., determine the costs associated with excess nutrient reduction). Strategies are the vehicles for attaining the goals. Implementing ten comprehensive strategies will permit these goals to be attained, provide answers to these four questions, and result in the reduction of excess nutrient loading to Mississippi's streams, estuaries, bays, and the Gulf of Mexico.

The purpose of the Upland Nutrient Reduction Strategic Plan is to guide the development of watershed management implementation plans. The target audience for the strategic plan includes local agencies and organizations with a mission for environmental and water quality restoration and protection, and local, state and federal agencies with the authority to develop and implement nutrient reduction plans and practices. However, this strategic plan was developed with input from stakeholders from the Mississippi Upland region because it is at the local level – the individual watershed – that nutrient reduction practices are planned and implemented.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

The Mississippi River/Gulf of Mexico Hypoxia Task Force released the *Gulf Hypoxia Action Plan for Reducing, Mitigating, and Controlling Hypoxia in the Northern Gulf of Mexico and Improving Water Quality in the Mississippi River Basin* in June 2008. The task force is co-led by the US Environmental Protection Agency (EPA), and the Mississippi Department of Environmental Quality (MDEQ), and includes environmental and agricultural agencies from states within the Mississippi/Atchafalaya River Basin (MARB), as well as federal agencies whose mission deals with agriculture and water quality-related issues. A key component of the Gulf Hypoxia Action Plan is the development and implementation of state nutrient reduction strategies. Mississippi is also a member of the Gulf of Mexico Alliance (GOMA) and leads the Nutrient Priority Issue Team. In June 2009, GOMA released its Governor's Action Plan II for Healthy and Resilient Coasts. A key component of this plan includes a focus on developing and implementing state nutrient reduction strategies.

The Gulf Hypoxia Action Plan and Governor's Action Plan II both call for state nutrient reduction strategies.

Mississippi initiated its nutrient reduction planning process by developing regional nutrient reduction strategies. These regional strategies are intended to provide guidance for nutrient reduction in local watershed implementation planning efforts. Implementation of nutrient reduction practices will occur through the development of local watershed implementation plans. The regional strategies are intended to promote consistency, comparability, and compatibility among the local nutrient reduction efforts within a region, and the state.
In 2009, MDEQ co-led an effort with Delta Farmers Advocating Resource Management (F.A.R.M.) to develop a nutrient reduction strategy for the Delta region of Mississippi, Mississippi's primary row-crop agricultural area (MDEQ/ Delta F.A.R.M. 2009).

Following the development of Delta nutrient reduction strategy, MDEQ led a GOMA workshop with the other Gulf of Mexico states (AL, FL, LA, TX) to develop a coastal nutrient reduction strategy template. This template was used as the framework for developing nutrient reduction strategic plans for the Coastal Region of Mississippi and this Upland Region plan. All three regional nutrient reduction strategic plans focused on answering four questions:

Mississippi nutrient reduction strategies focus on 4 questions.

1. What levels of nutrient reduction are achievable and by when?
2. What will nutrient reduction cost?
3. What is the value to each stakeholder from these nutrient reductions?
4. What levels of nutrient reduction will protect Upland waterbodies and benefit the Gulf of Mexico?

PROCESS FOR DEVELOPING NUTRIENT REDUCTION STRATEGIC PLAN

Nutrient reduction strategy process

The process for developing a nutrient reduction strategic plan that has emerged is illustrated in Figure 1. It begins with a vision, a compelling picture of how nutrient reduction to Upland ecosystems contributes to an improved quality of life – environmentally, economically, and socially (Figure 1). The vision, in part, establishes the conditions to be achieved through the process of reducing nutrients to Upland ecosystems.

A vision guides process.

Vision: The Mississippi Uplands is a region where a healthy environment contributes to, and is supported by a sustained, productive, and profitable economy, both contributing to an improved quality of life for its residents.

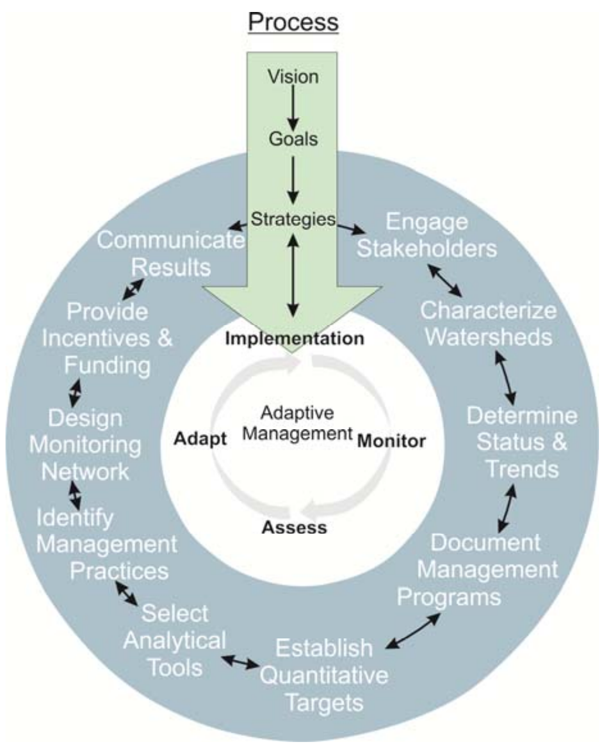

Figure 1. Process for developing nutrient reduction strategic plan.

The next step is to establish goals that flow from that vision (Figure 1). The goals for the Upland nutrient reduction strategies are:

Goals flow from the vision.

1. Determine what levels of nutrient reduction are achievable and by when,
2. Determine the costs associated with these nutrient reductions,
3. Quantify the value and benefits to stakeholders from these reductions, and
4. Determine what levels of nutrient reduction will protect Upland waterbodies.

Ten Strategies for Nutrient Reduction Planning

Strategies are the vehicles for attaining the goals. The ten strategies proposed for nutrient reduction planning, as shown on Figure 1, are:

- Engage stakeholders,
- Characterize watersheds,
- Determine status and trends,
- Document management programs,
- Establish quantitative targets,
- Select analytical tools,
- Identify management practices,
- Design monitoring networks,
- Provide economic incentives and funding, and
- Communicate results.

The order in which the strategies are shown in Figure 1 reflects the suggested general order of priority during the development process. Developing a nutrient reduction strategic plan, however, is an iterative process that can be initiated through any of the ten strategies. The two-way arrow between the strategies and the adaptive management cycle illustrates the iterative nature of the process (Figure 1). Once a strategic plan is implemented, the results will be monitored and the effectiveness assessed. At that point the strategic cycle may be revisited to modify the existing plan based on what has been learned during implementation, monitoring, and assessment.

FOUNDATION – GUIDING PRINCIPLES AND BUILDING BLOCKS

Guiding Principles

Five principles guide the *Governors' Action Plan II* (GOMA 2009). These five principles also guide Upland nutrient reduction strategic planning:

1. Encourage voluntary, incentive-based, practical, cost-effective actions.
2. Use existing programs.
3. Follow adaptive management, starting with what you have and improving over time.
4. Identify existing and additional funds needed and funding sources.
5. Identify opportunities for innovative, market-based solutions.

Building Blocks

A number of building blocks on which to develop nutrient reduction strategies that were identified as part of the GOMA effort are applicable for Mississippi Upland watersheds:

1. Use collaborative, inclusive teams of stakeholders (i.e., governmental agencies, non-governmental organizations, academic institutions, agricultural producers, landowners, and businesses) to prepare strategies.
2. Leverage resources (budgetary, personnel, expertise, and projects).
3. Formulate integrated, comprehensive nutrient reduction strategies and implementation plans, and, where possible, incorporate them into ongoing state programs.
4. Decide where the greatest benefits can be obtained using existing funds, recognizing that through adaptive management, additional priorities can be addressed over time.
5. Emphasize local watershed nutrient reductions and water quality improvements, which collectively provide cumulative, regional benefits for downstream waterbodies and the Gulf of Mexico.
6. Include both water quality protection and restoration activities in the strategies.
7. Recognize that small catchments are nested within watersheds, which are nested within river basins, which are nested within large drainage basins connected to the Gulf of Mexico. Multiple time and space scales must be considered in formulating comprehensive nutrient reduction strategies.
8. Focus on sustainability. While short-term successes are important, the focus must be on long-term, sustainable solutions.

Nutrient reduction strategies based on these fundamentals incorporate the principal components of watershed-based management planning and implementation. As a result, these strategies are applicable for small catchments through HUC12 and HUC8 watersheds, as well as at the basin level.

INTENDED AUDIENCE

Intended Audience

The target audience for the Upland nutrient reduction strategic plan will be stakeholders within much of Mississippi, including:

- ❖ Local agencies and organizations with a mission for environmental and water quality protection and restoration, working with private businesses, landowners, and citizens; and
- ❖ State and federal agencies with the authority to develop and implement nutrient reduction plans and practices, and who also work with private sector businesses, civil society organizations, and the public.

This strategic plan is designed to address excess nutrient reduction in those parts of the state not addressed in the Delta or Mississippi Coast strategic plans, referred to here as the Uplands (Figure 2). Development of this strategy document was initiated with a stakeholder issues workshop held on December 13, 2010, in Jackson, Mississippi. The purpose of this workshop was to initiate dialog with stakeholders.

This strategic document applies to Mississippi Uplands.

The issues, barriers, and opportunities identified by stakeholders were used to develop a draft Upland Nutrient Reduction Strategic Plan. This strategic plan was distributed to stakeholders and a stakeholder workshop was held on February 23, 2011, to discuss the draft plan and receive stakeholder comments and recommendations for revising the plan. This document incorporates these comments and recommendations. The next step is to distribute this plan to a larger audience for review and comment. These comments will be incorporated into an Upland nutrient reduction implementation plan. This implementation plan will provide guidance for the development and implementation of watershed management plans at the individual HUC12 level watershed. Detailed information about all of the strategies as they apply to the Mississippi Uplands, are presented in the following sections.

Stakeholders participated in development of this document.

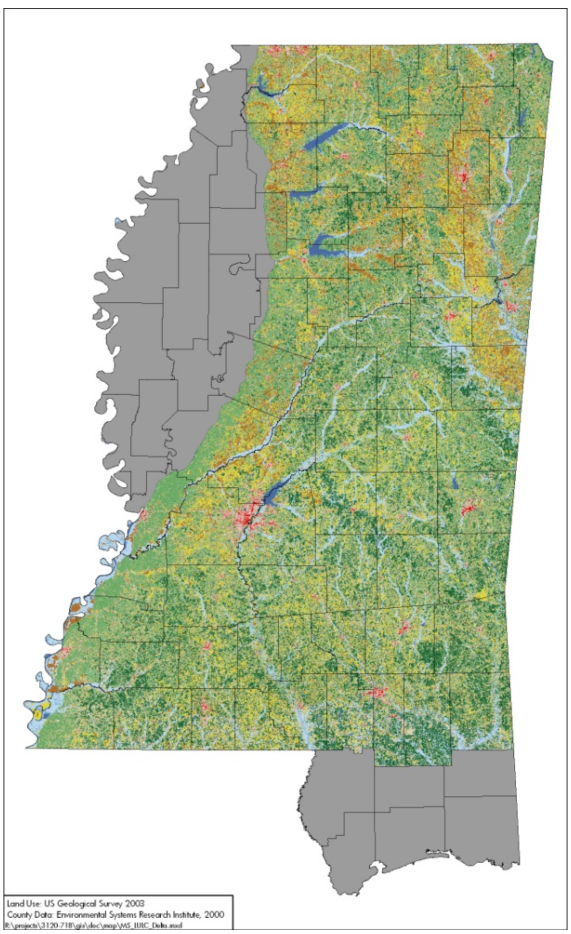

Figure 2. Mississippi Uplands.

STRATEGIES FOR UPLAND NUTRIENT REDUCTION

Each of the 10 strategies for upland nutrient reduction are presented below.

ENGAGE STAKEHOLDERS

Engage Stakeholders

Involving and engaging stakeholders early in the planning process is critical. Early involvement of stakeholders provides transparency of the process, allows time for trust to develop, incorporates local knowledge, and makes it possible to deal most effectively with misperceptions and to manage expectations. All of this helps gain buy-in and stakeholder cooperation and increases the likelihood of moving toward sustainable solutions.

An inclusive approach is critical, engaging stakeholders of different races, cultures, and gender. This provides a microcosm of the perspectives within the watershed, provides greater insight into stakeholder awareness of nutrient issues and expectations for nutrient reductions, and reduces the potential for controversy because a perspective or group was inadvertently not included.

Objective

Identify target audiences and their perceptions of excess nutrients as an issue in upland waterbodies and formulate effective awareness, outreach, and education programs to address these perceptions.

Identify audiences for outreach and education.

A. Identify the Audiences for Targeted Outreach and Education Programs.

1. Homeowners and landowners, including agricultural and timber producers, land managers, hobby farmers, developers, golf course superintendents, hunting and fishing clubs, and property owners' associations;
2. Municipalities and counties, including county boards of supervisors, mayors, city managers, park and recreation personnel, municipal wastewater treatment supervisors;
3. Industry and business, including environmental managers responsible for point source and stormwater discharges, and commercial fishermen;
4. State and federal regulators, including state and federal land managers (e.g., MDWFP, Corps of Engineers), NRCS and extension specialists;
5. Professional organizations and associations such as the Chamber of Commerce, Rotary Club, Cattlemen's Association, Poultry Association, and Timber Association;

6. Academic and research institutions, including K-12 primary and secondary teachers and administrators, community colleges, and private and public education institutions;
7. Environmental community, such as the Land Trust, the Nature Conservancy, Audubon, Sierra Club, Wolf River Conservancy, and Mississippi Coalition of Conservation Organizations; and
8. General public.

B. Determine the Awareness and Beliefs of Each Audience About Nutrient Issues.

Determine the awareness and beliefs of each audience about nutrient issues.

1. Determine the underlying beliefs of each of the target audiences concerning excess nutrients in Upland waterbodies**.**
   a. Review policy, vision, mission, and value statements of various organizations (i.e., community beliefs) representing these target audiences for initial understanding of awareness and beliefs related to nutrient issues.
   b. Using information from policy, mission, etc., statements, formulate questionnaires and conduct surveys to elicit individual beliefs of representatives from each of these target audiences.
   c. Compare individual and community beliefs with current factual understanding of nutrient elements and issues.
   d. Document desired behaviors that appeal to the various target audiences.
   e. Determine potential barriers associated with attaining the desired behaviors.
   f. Compare relevant findings from GOMA Environmental Education social survey with results from this survey.
2. Document areas where perception is inconsistent with current factual understanding of nutrient issues.
3. Identify existing awareness programs and tools that could be used or leveraged.

C. Develop Outreach Programs for Each Audience.

Develop outreach programs for each audience.

1. Engage MDEQ Upland Basin Team members, and local organizations to determine effective outreach efforts.
   a. Identify champions (individual or organizations) to lead

outreach efforts.

b. Describe interrelationships among various target audiences using conceptual social network maps, and identify key individuals for outreach.

c. Identify existing outreach programs and tools applicable to upland watersheds and build on local efforts.

2. Document media used by various target audiences to both receive and communicate information.

g. Determine what outreach activities have previously been conducted or are on-going.

h. Characterize the effectiveness of each of these activities in increasing stakeholder awareness about environmental issues.

3. Contrast different perspectives among stakeholders.

a. Identify common ground where there is agreement among different stakeholders.

b. Identify areas of controversy or disagreement and reasons for disagreement.

i. Begin outreach efforts in areas where there is an agreement of common ground among stakeholders.

4. Create an environmental stewardship recognition program and awards.

a. Promote on-going environmental stewardship programs, such as those of the Mississippi Farm Bureau Federation, Mississippi Cattlemen's Association, Mississippi Wildlife Federation, and similar organizations or agencies.

b. Recognize companies, communities, organizations and individuals for their contributions to nutrient reduction and environmental stewardship.

c. Assist partner agencies/organizations in establishing environmental stewardship award programs.

d. Celebrate these successes.

D. Develop Education Programs for Each Audience.

Develop education programs for each audience.

1. Engage MDEQ Upland Basin Team members and local Upland

organizations to develop educational programs for specific target audiences.

a. Build on existing programs and brands and develop messages that address specific areas where perception and factual understanding are incongruent.

b. Develop guidelines for reducing barriers associated with the desired behaviors.

c. Reinforce messages where perceptions are consistent with factual understanding and contribute social, economic, and environmental benefits.

d. Deliver messages through appropriate media, including association newsletters, magazines, websites, TV, and radio spots, and trusted sources, using social marketing approaches, and social media (e.g., Twitter, Facebook).

e. Use existing tools and leverage existing programs such as the Land Trust, Audubon, MSU Cooperative Extension, MDEQ NPS, and similar educational programs.

2. Work with primary and secondary school teachers and administrators to develop K-12 curriculum, promote Envirothon or similar competitions, and environmental stewardship programs. These programs should be coordinated with the business/ organization/ agency stewardship award programs mentioned earlier.

3. Formulate economic incentives to encourage acceptance and adoption of desired behaviors (see Economic Incentives and Funding Strategy).

4. Identify and document economic and social benefits for individual landowners and businesses, as well as community socioeconomic benefits.

E. Document the Results of Outreach and Education Efforts.

Document the results of outreach and education efforts.

1. Formulate quantitative measures of success for stakeholder awareness, outreach and education and track these over time to document behavioral changes.

a. Consider social indicators being piloted in the Great Lakes states by the US Department of Agriculture (USDA) Cooperative Research, Education, and Extension Service as potential measures of success (http://www.joe.org/joe/2009april/a1.php).

b. Document on-going conservation and nutrient reduction activities being conducted by homeowners, producers, growers, businesses, organizations and associations without economic incentives or government funding. Promote these Upland stewardship success stories and encourage peers to build on these efforts.

.

CHARACTERIZE WATERSHEDS

Characterize Watersheds

This strategy includes delineating and characterizing the Upland watersheds that will be addressed by the strategy. Watershed characteristics include geography, ecology, socioeconomics, and stakeholder interest and willingness to participate. Characterizing current conditions provides a baseline against which the effects of restoration and protection activities can be assessed (see Status and Trend strategy).

Objective

Characterize, prioritize, and target (select) watersheds in which to implement nutrient management practices.

A. Evaluate Watershed Characteristics that Affect Nutrient Runoff.

Evaluate watershed characteristics that affect nutrient runoff.

1. Delineate watersheds by Hydrologic Unit Code (HUC) from the smallest scale available to 8-digit HUCs.
2. Within each HUC, characterize the watersheds by:

   a. Watershed size;
   b. Land use/land cover, including potential high nutrient loading areas or "hot spots" as well as areas with potentially low nutrient loading (including public lands, forests, and lands in conservation programs through NCRS, Land Trust, TNC and similar efforts);
   c. Physiography/relief;
   d. Hydrologic types (e.g., ditches, stream order, reservoirs, oxbows);
   e. Current management practices;
   f. Levees, channelization, weirs, dredging, other stream modifications, etc.;
   g. Previous or ongoing studies;
   h. Urban/suburban areas and municipal boundaries;
   i. Projected land use change, or planning efforts;
   j. CAFOs/AFOs.
   k. Geology;
   l. Point source dischargers (note if have N, P permit limits or monitoring requirements) including MS4 stormwater outfalls;
   m. Soil associations;
   n. Wetlands and wetland mitigation banks;
   o. Groundwater source protection areas and surface water withdrawal locations (general location)
   p. Historical information, including historical land use, if available;
   q. Impaired waterbodies;
   r. Completed total maximum daily loads (TMDLs);
   s. Golf courses; and
   t. Mining sites.

3. Coordinate with AL, AR, LA, and TN in characterizing watersheds that cross state boundaries. Include historical and ongoing efforts and activities similar to those described above.

4. Characterize landscape patterns using the Mississippi Watershed Characterization and Ranking Tool, and develop an Index of Watershed Similarity. Index would assist in impaired watershed identification (see Analytical Tools strategy).

B. Prioritize Watersheds.

Prioritize watersheds for nutrient reduction based on public information about selected characteristics.

1. Base prioritization on the following subset of watershed characteristics:

   a. Watershed size - typically no larger than HUC12 watersheds;
   b. Occurrence of point sources and MS4 stormwater outfalls;
   c. Geographic location;
   d. Presence of channelization or other stream modifications;
   e. Impaired waterbody segments;
   f. Completed TMDLs;
   g. Head cutting/gully forming erosion;
   h. Likelihood of stakeholder participation;
   i. Waterbody type(s);
   j. Watershed nutrient loads/nutrient instream concentrations;
   k. Availability of historical data;
   l. Existing or potential for green infrastructure such as connecting hubs and corridors, creating green space, wetlands, bioswales, low impact development or similar practices;
   m. Riparian areas and stream stability; and
   n. Presence of existing management/restoration projects.

2. Prioritize using Best Professional Judgment (BPJ) of a team of professionals familiar with the region and watersheds of concern.

C. Target Watersheds.

Gather on-the-ground local information to target watersheds.

1. Conduct "on-the-ground" survey to determine:

   a. Stakeholder interest – are people willing to volunteer their time, money, resources to implement and/or maintain nutrient-reducing best management practices (BMPs), input management, or green infrastructure practices?

i. Stakeholder interest and willingness is critical for selecting watersheds for implementation.

ii. Use information gained through the strategies to engage stakeholders to determine stakeholder attitudes and beliefs about nutrition management practices and new technologies/approaches.

b. Local topography – what types of management or green infrastructure practices will the landscape allow?

c. Soil types – how do the soils contribute to the problem and/or influence what BMPs can be implemented and how?

d. Landuse practices – what types of golf course, residential homeowner, forestry, pasture, or manure/litter management practices are, or could be, in place?

e. Existing drainage – what types of drainage systems, particularly stormwater retention/discharge structures, are present, and what is their condition, potential for improvement/expansion?

f. Connectivity or potential connections among hubs and corridors to conserve/restore green infrastructure, including:

i. Forest infrastructure, green way, green space, riparian buffers, or wetlands;

ii. Connections via streams and rivers;

iii. Connections to local stream or lake systems that eventually flow into the Gulf,

iv. Connections to local lake/oxbow systems, or

v. Connections to an impaired downstream waterbody.

g. Nutrient and other impairments in the waterbody segment- are there also sediment, organic enrichment, bacteria, or other impairments in addition to nutrients?

2. Determine where ordinances, stormwater pollution prevention plans, and similar regulatory programs are in place (see Document Management Programs Strategy). Review development and land use plans prepared for future growth.

3. Use BPJ to select watersheds for implementation of nutrient

management practices.

4. Estimate the nutrient budget and contributing sources (see Analytical Tool strategy).

5. Identify opportunities for leveraging resources of multiple groups/agencies/programs (see Provide Incentives and Funding Strategy).

DETERMINE STATUS AND TRENDS

Determine Status and Trends

To assess the effectiveness of reduction strategies, the current level of nutrient loads and impacts must be documented as a reference for comparison. Historical conditions may be used as a target, so they should also be documented to the extent possible. Estimating the historical trends provides insight into the current trajectory of nutrient loadings to upland ecosystems. In addition, past conditions can indicate areas where legacy sediment and nutrient sources might be expected.

This strategic element can also include identifying any case studies that could help direct the implementation of nutrient management practices. Information from this element can inform the Watershed Characterization element. Both current status and historical trends can be considered as part of the prioritization process. The management practices selected and implemented will likely be different if the trend in nutrient loadings is decreasing versus increasing. Sustaining current management practices might be warranted if there is a decreasing trend in nutrient loads compared to implementing new management practices if there is an increasing nutrient loading trend. These trends could also be cross-referenced with future land use projections identified as part of the Watershed Characterization element to provide insight into nutrient load sources.

Objective

Document historical trends and establish current baseline of nutrient concentrations and loads in upland waterbodies.

A. Historical Trends

Gather historic information and identify long-term trends in nutrient loads, concentrations, sources, management impacts, and issues.

1. Query agencies, organizations, and scientists working in the uplands for historical water quality, nutrients, and biological monitoring information or studies.
2. Establish quality assurance and minimum period of record criteria for both assessing current status and historical trends in nutrient concentrations/loads and biological responses to these loads and screening historical information against these criteria. Determine whether there have been methodological changes in analytical techniques that could bias trends.
3. Review historical land use/land cover changes in upland watersheds to identify potential legacy influences on current condition (see Watershed Characterization, Select Analytical Tools strategies). These historical trends should also consider trends in BMP implementation and land in CRP, WRP, conservation programs.

4. Establish flow (discharge) – nutrient-loading relationships and seasonal patterns (see Select Analytical Tools strategy).
5. Determine if there are relationships among biological response metrics/indicators and nutrient concentrations/loads. Historical projections may also have been modeled, which can provide perspective.
6. Assess potential effects of changing analytical methodologies on trend analyses.
7. Evaluate spatial distribution of historical/current monitoring sites and hydrologic waterbody types in establishing historical trends and current status (see Design Monitoring Networks strategy).
8. Determine direction of nutrient trends for upland streams and lakes. Are trends getting better or worse (i.e., increasing nutrient concentrations or loads, increasing chlorophyll concentrations, decreasing water clarity)? Where are these trends occurring?

B. Current Status

Gather and analyze current data to determine current status of nutrient loads, concentrations, sources, impacts, management, and issues.

1. Determine locations of current monitoring sites and the characteristics of their watersheds, including hydrologic type (see Watershed Characterization, Design Monitoring Networks strategies).
2. Estimate nutrient loads for current locations and rank from lowest to highest.
3. Establish relationships, if any, among land use and nutrient concentrations/loads and among nutrient concentrations/loads and biological responses (see Watershed Characterization, Select Analytical Tool strategies). Models may be available to provide current status (e.g., regional SPARROW)
4. Rank locations according to biological condition (e.g., fish, benthic index of biotic integrity, periphyton index) and compare with ranking based on nutrient loads.
5. Identity areas where TMDLs have been conducted and excess nutrient load reductions are required.
6. Identify areas where streams, lakes are attaining designated uses and need to be protected.
7. Identify these areas where there is no monitoring.
8. Partition current loads for each watershed into

    - Point source contribution,

- Non-point source contribution, and
- Atmospheric deposition.

C. Case Studies

Use case studies to document how effective management practices have been in reducing nutrients.

1. Collate and compile studies that have assessed land use, nutrient concentrations/loading, and/or biological condition in upland waterbodies.
2. Focus specifically on case studies that document effectiveness and efficiencies of management practices on reducing excess nutrients.
3. Synthesize "lessons learned" from these studies and use these lessons to inform or revise the plan. Document what nutrient reductions have been achieved and the associated costs in other Gulf of Mexico and Mississippi River Basin states and watersheds.

DOCUMENT MANAGEMENT PROGRAMS

Document Management Programs

Reviewing and documenting existing regulations, policies, management programs and planning areas not only helps to identify authorities, options, and alternatives for reducing nutrients, but also helps identify opportunities for leveraging with other programs to reduce nutrient loads.

Objective

Document current laws, regulations, policies, ordinances, zoning, and management programs relevant to reducing nutrients to upland streams, lakes, and reservoirs.

Document applicable regulations and policies.

A. Document Applicable Regulations and Policies.

1. Document existing regulations, policies, and ordinances for water, air, solid waste discharges, emissions, or land applications/incineration, including stormwater regulations and manure/nutrient management plans.
2. Document air and water quality standards for nitrogen species and TMDL target loads for sediment, nitrogen, and phosphorus for upland waterbodies.

Document existing planning activities.

B. Document Existing Planning Activities.

1. Review county and municipal ordinances and determine minimum requirements for green space, low impact development, or similar green infrastructure elements.
2. Review and document any regional planning efforts on future growth and development.
3. Review municipal and county plans for green space, green infrastructure, requirements for low-impact development, etc., for future growth and development.

Document active and available management programs.

C. Document Active and Available Management Programs.

1. Determine which USDA programs (e.g., EQIP, CRP, WRP, Healthy Forest, Preserve Farmland Protection Policy Act) are applicable for, or are active in the upland counties.
2. Review stormwater management programs for each municipality and county.

3. Review other resource management programs active in the upland counties and/or waterbodies. A number of nonprofit organizations support management programs including Land Trust, The Nature Conservancy, and the Audubon Society. State and federal agencies manage areas for wildlife conservation (e.g., MDWFP). Private wetland mitigation banks have also been created.

ESTABLISH QUANTITATIVE TARGETS

Establish Quantitative Targets

Quantitative nutrient reduction targets provide the adaptive management process with targets against which future progress can be evaluated. Ultimately, numeric nutrient water quality standards are expected to provide criteria for nutrient reduction activities to attain waterbody designated uses and protect and improve ecosystem services. However, numeric nutrient criteria are in the process of being developed and are not anticipated until 2013. Until these criteria are finalized and promulgated, numeric targets can be established based on TMDL target reductions, historic or current nutrient loads, (e.g., Pearl River TMDLs), or what is achievable with available practices and funds.

Objective

Establish nutrient targets that support designated uses of upland streams, oxbows, and reservoirs and estimate nutrient reductions needed for non-attaining waterbodies.

Set quantitative targets for nutrient reduction based on available data and studies.

A. Setting Targets Prior to Promulgation of Nutrient Criteria

1. Determine what nutrient targets were used in the TMDLs and point source permitting and compare with current concentrations and loads (see Determine Status and Trends strategy).
2. Where possible, determine appropriate response targets (e.g., DO, fish IBI, M-BISQ, chlorophyll a) associated with nutrient targets.
    a. Consider public perception of "greenness" and water clarity associated with attaining and non-attaining water bodies.
    b. Consider quality of life or amenity indices or measures with public appeal and recognition that are tied to nutrient or response targets.
3. Determine what percent nutrient reductions were recommended in the TMDLs (e.g., point and nonpoint sources and atmospheric deposition within each watershed).
4. Determine annual nutrient loads and concentrations (N, P) for Upland streams and lakes currently attaining designated uses.
    a. Determine land use/land cover acreages for attaining watersheds.
    b. Assess intra- and inter-annual variability in loads and concentrations for these watersheds.
    c. Evaluate potential growth or development projected for the watershed (see Watershed Characterization, and Document

Management strategy).

5. Evaluate the nutrient reduction effectiveness achieved by previously implemented management practices (regardless of the pollutant) and trends in nutrients following implementation. Use this information to establish incremental nutrient reduction targets.
6. Review targets established by other surrounding states, particularly TN, that might be applicable for MS waters.

B. Nutrient Criteria as Targets

Use numeric nutrient criteria as nutrient reduction targets once they are promulgated in 2013.

1. Numeric nutrient criteria are being developed that will replace the quantitative targets. A state-wide process is being used to develop regionally relevant, numeric nutrient criteria.
2. MDEQ has established a Nutrient Criteria Work Group composed of stakeholders from numerous local, state and federal agencies, professional organizations, academia, environmental communities, farmer and rancher organizations, and business and industry. This group that is systematically analyzing data and information collected throughout the state, evaluating the different types of waterbodies in MS, and the characteristics of these waterbodies; reviewing the designated uses of these various types of waterbodies; and ultimately determining what numeric nutrient criteria will protect these designated uses.
3. These numeric nutrient criteria will be used to determine limits for point source discharges and incorporated into National Pollution Elimination Discharge Permits (NPDES) and stormwater permits to regulate point source nutrient discharges into waterbodies.
4. These numeric nutrient criteria will become the quantitative targets for nonpoint source nutrient loadings into waterbodies.
5. These numeric nutrient criteria will be established by waterbody type and region of MS and placed into regulations for the Coastal and Upland Regions in 2013 and for the Delta in 2014.

SELECT ANALYTICAL TOOLS

Select Analytical Tools

Numerous tools are available for estimating and assessing potential nutrient reductions from different management practices, and the associated benefits of attaining designated uses. It is important to identify which tools are applicable for Upland ecosystems and watersheds, and document the associated assumptions, inputs, and output results.

Objective

Guide the application of tools in order to develop the most efficient and effective action plans for the selected watersheds.

A. Identifying Applicable Tools

Recognize that different tools may be needed to evaluate edge of field effects versus river basin effects.

1. Identify which tools are most appropriate at different scales and answer different questions related to:
    a. Watershed characterization (soil surveys, land use, relationships among land use and nutrient concentrations/loads, biotic metrics, etc.).
    b. Management practice effectiveness and nutrient reductions, e.g., different combinations of BMPs at different locations within selected watersheds.
    c. Projected land use changes, development, etc., and associated nutrient loading changes.
    d. Identification of critical monitoring locations.
2. Identify tools previously or currently being used to predict water quality in MS upland streams and lakes (e.g., regional SPARROW, Aberdeen Pool model).
3. Develop an inventory of these models and incorporate links to these models in the GOMA Nutrient Reduction Decision Support Tool Box.
    a. Include agricultural models (ANNAGNPS) as well as watershed models in the inventory (e.g., SWAT).
    b. Include urban and stormwater models (SWMM, STORM) for MS4 and stormwater runoff.
4. Select those tools that are applicable for the types of watersheds and waterbodies in the Upland areas, and the questions to be answered.
    a. For smaller, well-characterized watersheds, use geographical information systems (GIS) mapping

capabilities with knowledgeable stakeholders and best professional judgment to locate management practices.

b. For larger, more diverse watersheds, consider using quantitative models, including the Mississippi Watershed Characterization and Ranking Tools, for targeting the location of management practices in reducing nutrients.

c. As a general rule, use all the tools that are applicable within time and budget constraints. Get confirmations from multiple tools.

Tools can be used in development and implementation of nutrient reduction plans.

B. Using Tools for Nutrient Reduction

1. Use tools to estimate current nutrient budgets for the watershed.

   a. Consider watershed size in tool selection.

   b. Estimate current loads both for nutrient inputs applied throughout the entire watershed and for nutrient exports reaching the mouth of the watershed.

   c. Based on these estimates, identify both the most significant nutrient sources and those sources that can be most effectively reduced.

2. Use the analytical tools to compare different nutrient reduction strategies in the watershed.

   a. Determine desired nutrient reduction target(s). Target could be in terms of the nutrient concentration/load or an ecological endpoint.

   b. Assess the effects of spatial variability in soils, topography (i.e., slope), or other factors on nutrient reduction.

   c. Identify appropriate locations for implementing or clustering management practices to reduce nutrients.

   d. Assess the potential impacts of future land use, development, agricultural/timber practice changes on implemented structural management practices.

   e. Include assessing nutrient reductions associated with green infrastructure practices, such as green space, low impact development, conservation easements, and urban reforestation.

3. Track the implementation of the BMPs (e.g., use GIS to document BMP deployment) to help evaluate BMP effectiveness.

IDENTIFY MANAGEMENT PRACTICES

Identify Management Practices

Numerous management practices for both point and nonpoint sources have been implemented to reduce nutrient concentrations and loadings. Management practices should consider not just the traditional point and nonpoint source management practices, but also water and input management practices. Recycling and reusing water can significantly reduce nutrient loadings. Nutrients that are not applied in the watershed cannot enter the water systems.

A critical part of this strategy is also the estimation of costs and benefits associated with the management practices. Costs include not only the capital costs for implementation, but also the operation and maintenance costs. Several case studies have identified maintenance after installation as the necessary ingredient for effective nonpoint source management practices that is often lacking. Benefits can be monetary and non-monetary, direct and indirect. Direct, indirect, and non-monetary costs associated with not implementing management practices (i.e., no action alternative) also need to be estimated. Benefits can be more difficult to quantify because some benefits are not marketable. Non-market valuation approaches are improving (e.g., ecosystem services valuation techniques), but other valuation procedures are needed.

Objective

Integrate sustainable input and water management practices with nutrient reduction management practices to reduce nutrient loadings and/or increase denitrification in upland waterbodies.

I. Nonpoint Source Management Practices

A. Water Management Practices

Water management practices can contribute to nonpoint source nutrient reduction.

1. Identify water management practices that will increase water residence time on watershed soils to increase potential for infiltration and denitrification.
2. Use rain gardens, bioswales, and other management practices to reduce or eliminate runoff. Nutrients will not be transported to receiving waterbodies if there is no overland flow or runoff. These practices can be retrofitted into existing neighborhoods and commercial districts, and incorporated in new development, including highway construction.
3. Reuse/recycle runoff or treated wastewater for cooling, irrigation, or dust control on construction sites or road construction, or other non-drinking water uses.
4. Capture stormwater runoff from CAFO/AFO facilities in lagoons

for reuse/recycle for wash water, irrigation, etc.

Conservation practices can contribute to nonpoint nutrient reduction.

B. Conservation Practices

1. Implement conservation practices to reduce runoff, and nutrient requirements. Timber, native vegetation, and grassed areas have significantly less runoff than exposed ground or impervious surfaces such as pavement, sidewalks, and parking lots.
2. Recycle nutrients in runoff back onto yards, peaks, golf courses, green spaces, timber acreage, etc., to reduce nutrient input requirements (with Input Management) and satisfy grass, sod, timber, crop water requirements.

Reducing inputs can contribute to nonpoint source nutrient reduction.

C. Input Reduction Practices

1. Document decreased costs/increased revenue for homeowners, agricultural growers/producers, or businesses who have implemented input management practices/plans in production or business operations.
2. Identify economic incentives and funding for "green" projects or demonstrations that can document savings associated with input management.
3. Determine what information would be needed to change homeowners', growers'/producers', businesses' perception of the benefits of using input management practices/plans to reduce fertilizer application.
4. Encourage soil testing, precision agriculture, and variable rate fertilizer application for crops and pastures.
5. Identify specific target audiences to pilot input management practices and document benefits.
6. Implement the GOMA social marketing practices to create awareness of over fertilizing lawns and change homeowner fertilizer practices.

Non-Traditional BMPs

D. Non-traditional Management Practices

1. Foster the development of management teams between poultry growers and integrators (i.e., contract corporation) to address poultry litter and dead bird management. Several surrounding states have policies for developing these management teams.
2. Encourage new waste treatment technologies that digest poultry

litter and animal manure to generate methane for heating poultry/confined animal facilities and co-generating electricity.

3. Consider a NRCS CGI or Ag Star proposal that would integrate management team formation and the use of new or emerging technologies for reducing poultry litter and animal manures. Some facilities are digesting a mixed municipal garbage, food processing, and poultry litter waste with benefits to all parties. (See Incentives and Funding).

4. Promote the development and implementation of nutrient management plans for golf courses, public lands, and other non-agricultural facilities that fertilize extensively. Form support teams with membership from MDEQ, MSWCC, NRCS, and non-governmental agricultural organizations to help producers/growers and others develop, implement and evaluate their nutrient management plans.

5. Identify management practices applicable for hobby farmers and develop outreach and education material, and distribution system to reach these groups. (See Stakeholder Awareness, Outreach, and Education)

6. Promote composting of waste and partner with local farmers markets, nurseries, lawn care businesses, landscaping companies, and construction companies to use this compost.

E. Selecting Non-Point Source Management Practices

Select Nonpoint source best management practices for application.

1. Review watershed characteristics (from Watershed Characterization strategy), including areas where BMPs are currently in-place, and target sites or hot spots where BMP implementation could contribute to nutrient reductions.

2. Identify nutrient reduction BMPs that may generate nutrient reductions through proper application and maintenance in the region.

3. Use the International Stormwater BMP Database (www.bmpdatabase.org) or similar analytical tool to prioritize nutrient reduction BMPs based upon performance potential measured by professional knowledge, existing research, literature, and monitoring data as well as added economic and environmental benefits using criteria such as:

   a. BMP category – avoid, capture, trap (ACT-NRCS);

   b. Suites of BMPs that go together and can be bundled for implementation;
   c. Constituent of concern – sediment, nutrients, water;
   d. Expected percent reduction;
   e. Impacts, if any;
   f. Cost to install and maintain;
   g. Time to install;
   h. Acres of land required for implementation;
   i. Compatible/incompatible with other BMPs; and
   j. Direct/indirect benefits to individual or business paying for implementation.

4. Work with retailers, lawn care businesses, growers/producers, homeowners, and other land/resource users to develop watershed nutrient reduction strategies.
5. Apply watershed nutrient reduction strategies by developing specific nutrient reduction strategies in conjunction and cooperation with individual landowners, home owners, and other land/resource users. These strategies should include:
   a. Site identification for potential BMPs,
   b. Appropriate BMP selection,
   c. BMP installation and maintenance instruction,
   d. Financial assistance, and
   e. Continuing technical assistance.

II. Point Source Management Practices

A range of point source management practices can contribute to nutrient reduction.

A. Evaluate Alternative Technologies.

1. Review the range of wastewater treatment technologies currently being used by upland communities.
2. Review and evaluate alternative treatment technologies for upland wastewater systems, including:
   a. Wastewater to wetlands;
   b. Wastewater for golf courses, parks, or public area watering or irrigation;
   c. Land application of residual solids generated at wastewater

treatment facilities;

d. Generation of methane for heating and cogeneration of electricity from residual solids, food processing (poultry) waste, and garbage with use of digester cake as soil amendment, or other products.

e. Reuse, recycling opportunities and options;

f. Decentralized, onsite treatment systems with zero discharge; and

g. Integrated onsite/instream treatment systems for some streams where instream structures or characteristics might reduce nitrogen loading through denitrification and sequester phosphorus loads in sediments.

3. Run collection/sewer system from regional WWTPs, to subdivisions currently using septic systems and require hook-ups.

4. Conduct a wastewater treatment workshop for operators, design engineers, construction contractors, and other appropriate entities on alternative wastewater treatment technologies with potential applicability to Upland systems.

5. Review locations of facility outfalls and evaluate alternative outfall locations that could minimize nutrient effects and/or integrate instream processes for nutrient removal.

B. Improve Treatment Effectiveness.

Improving treatment effectiveness and efficiencies can also reduce nutrient loads.

1. Increase the efficiency and effectiveness of existing wastewater treatment facilities through:

a. Operational changes in existing facilities, and

b. Operator training on increased efficiency of operations.

2. Review influent quality and implement approaches that will either reduce nutrient loads in the influent to the treatment system, or modify influent quality to improve treatment effectiveness and/or efficiency.

C. Establish Numeric NPDES Nitrogen and Phosphorus Limits.

1. Establish quantitative nitrogen and phosphorus NPDES limits that are achievable and cost-effective.
2. Monitor nitrogen and phosphorus concentrations and flow in both the effluent discharge and downstream to document nutrient load reductions and associated instream effects.

D. Reduce Stormwater Nutrient Loads.

Reducing nutrient loads in stormwater runoff is critical.

1. Evaluate nutrient loads from all sources – urban/suburban, industrial, and commercial.
2. Determine what nutrient load reductions are achievable and cost-effective by source type through various BMPs for both water quantity and water quality.
3. Integrate green infrastructure management practices– bioswales, rain gardens, porous pavement, pixilated parking, alternative curbs, urban reforestation, parkways, and conservation development– as part of current incentives for development. These practices can also be retrofitted in built communities.
4. Establish nitrogen and phosphorus NPDES stormwater permit limits based on these results.
5. Develop awareness, outreach and education programs on reducing stormwater runoff and nutrient loading, targeting specific types of nutrient sources.

III. Management Practices for Atmospheric Nutrients

Some management practices can reduce atmospheric deposition inputs of nutrients.

A. Promote urban forests and the Healthy Forest Preserve program to filter and remove atmospheric nitrogen species.

B. Implement green infrastructure practices to reduce nitrogen runoff in stormwater.

DESIGN MONITORING NETWORK

Design Monitoring Network

Effective monitoring programs can contribute to the nutrient reduction effort in a variety of ways. Monitoring data can be used for characterizing current conditions, establishing baseline or reference conditions, and tracking changes in both nutrient levels and biological responses. It can be used for estimating nutrient loads, and apportioning loads among sources. It can be used to develop relationships among nutrients and biological responses. Providing information to develop empirical relationships among nutrients and biological responses would significantly enhance the ability to assess the potential effectiveness of management practices for improved ecological responses to nutrient reductions. Monitoring data can also be used to document and track changes resulting from management to characterize effectiveness of nutrient management practices. Both pre-and post-implementation monitoring are needed to document the success of management practices.

Monitoring networks need to account for anticipated lags in system responses in larger watersheds as well as be sited to demonstrate early successes in smaller catchments.

This strategic element should consider which indicators and metrics to measure, and when, where, and how frequently to measure to adequately represent the condition of the system. Biological indicators of ecosystem response should be incorporated as part of the monitoring effort in addition to performance measure or metrics to track the progress in nutrient reduction. Being able to document nutrient reductions is becoming increasingly important.

Objective

Provide quality assured data to scientifically assess success of nutrient reduction efforts in Upland waterbodies, and to plan future nutrient reduction activities.

Determine Appropriate Spatial-Temporal Scales.

A. Determine Appropriate Spatial-Temporal Scales.

1. Consider watershed size in determining appropriate spatial-temporal scales for monitoring (with Watershed Characterization strategy).
   a. The size of the watershed that drains to the monitoring station will determine the duration of monitoring. The larger the watershed, the longer the lag in response time.
   b. Smaller, upstream watersheds have better likelihood of demonstrating early success of management practices in reducing nutrients because of response lag time in large

systems.

c. Evaluate possible relationships between size of the upstream watershed, location of management practices, and distance downstream where effects of nutrient reductions can still be observed.

2. Consider end use of the information in determining appropriate scales for monitoring.

a. Modeling data sets typically have different spatial-temporal scales than assessment data sets.

b. Evaluating long-term effectiveness of management practices has different spatial-temporal scales than determining the effectiveness of management practices during individual storm events (e.g., biotic water quality relationships, annual nutrient loading).

B. Determine Appropriate Reference Period.

Determine Appropriate Reference Period.

1. Assess system dynamics in determining the minimum period needed to establish a reference frame.

a. In general, the longer the better for establishing a reference.

b. One year is typically not sufficient to establish a reference.

c. Watershed characteristics such as size and land use can affect the reference baseline period (e.g., watersheds with legacy nitrogen and phosphorus might have considerable lag times before response to management practices can be observed).

2. Evaluate hydrologic period of record for various-sized watersheds and stream types in the Upland counties.

a. Flashy streams can require longer periods of record to establish a statistical reference frame compared to streams with long response times.

b. One of the primary interventions that might disrupt a short reference period are climatic extremes (i.e., drought or flood years).

c. Consider interventions in the watershed that can also affect stream responses (e.g., changing land use, weir installation, upstream dams, etc.).

d. Incorporate existing monitoring information directly, through indexing, or extrapolation to establish reference conditions.

Identify Management Practices to be Implemented.

C. Identify the Management Practices to Be Implemented.

1. Identify the management practices to be monitored:
   a. Input management – document homeowner/landowner fertilizer application rates and timing.
   b. Best management practices – document the maintenance of the BMPs in addition to the time since their installation, and track constituents of concern (i.e., sediment, nitrogen, phosphorus, biotic index).
   c. Point source discharge – determine the NPDES limits and track changes in effluent constituent concentrations/loads over time with permit renewal.
   d. Water management – monitor runoff from sites with and without management practices in place.

2. Consider attributes of these management practices in designing the monitoring network.
   a. System type– e.g., stormwater detention basins will require a different monitoring approach than rain gardens.
   b. System characteristics– e.g., nutrient management for pasture is different than nutrient management for crops.
   c. Seasonal/runoff differences– e.g., monitoring during the growing season will likely be different than during the non-growing season, including the responses of stream biota to nutrient inputs.

Establish Monitoring Site Locations.

D. Establish Monitoring Site Locations.

1. Consider multiple options for number of sites and their location.
   a. Upstream – downstream sites.
   b. Paired watershed sites.
   c. Before and after sites.
   d. Multiple downstream sites for cumulative assessment.
   e. Probabilistic versus targeted sites.
   f. Phased or rotating sites.

g. Integrator sites.

2. Integrate information above in determining the number and location of sites.

   a. Above-below sites might be appropriate for point source outfalls.

   b. Paired watersheds might be appropriate for smaller watersheds and those with limited baseline data.

   c. Consider monitoring locations that would strengthen watershed-scale model development by reducing model uncertainty.

   d. Consider locations that are strategic in assessing long term changes in watershed nutrient loading.

   e. Initiate and complete reconnaissance monitoring, if necessary, to identify watershed stream reaches with higher nutrient concentrations, to aid in siting BMPs and monitoring locations.

3. Leverage funding of site locations with other agencies or organizations and partner on selecting monitoring parameters and reporting.

4. Atmospheric deposition monitoring sites are already located at Coffeeville, Clinton and Newton, MS, as part of the National Trends Network (NTN).

E. Select What Will Be Monitored.

Select What Will Be Monitored.

1. Match the monitoring parameters with the project objectives and the management practices.

   a. Different nitrogen or phosphorus species might be associated with different management practices (e.g., nonpoint versus point sources).

   b. Physical measurements (e.g., temperature, specific conductivity) can indicate changes in water management practices.

   c. Incorporate variables or parameters of interest or value to stakeholders.

   d. Incorporate data parameters suitable for selected models if a model is to be used to extrapolate results to other similar watersheds.

2. Include biological as well as physicochemical parameters so relationships can be established between the biological or stream response and nutrient management practices.
    a. Biological parameters might include periphyton or stream algae, benthic organisms, fish, or waterfowl.
    b. Chemical parameters should include both nitrogen and phosphorus species.
    c. Physical parameters should include in situ measures of temperature, dissolved oxygen, specific conductance, pH, and turbidity.
3. Consider surrogate parameters that could reduce monitoring costs or resources.
4. NTN atmospheric deposition measures include precipitation, and wet deposition nitrate and ammonium concentrations and pH.

F. Establish Sampling Frequency.

Establish Sampling Frequency.

1. Integrate watershed, site, and hydrologic characteristics with desired outcomes from the management strategies.
    a. Evaluating management effectiveness for individual storm events will require intensive sampling during storms.
    b. Modeling data sets typically need both storm sampling and baseflow sampling.
    c. System responses during the growing season will likely be different than during the non-growing season, including the responses of stream biota to nutrient inputs.
2. Regardless of watershed or other attributes, ensure monitoring occurs over the annual hydrograph.
3. NTN deposition samples are collected once per week and represent an integrated sample of wet deposition for the previous week.

G. Provide Analysis and Assessment of Results.

Provide analysis and assessment of results.

1. Establish an information management system to store information.
2. Consider the analyses to be performed as part of the monitoring program design, rather than after monitoring has been initiated, such as watershed/stream modeling, geomorphic analyses, land use-nutrient loading, biotic-nutrient or other statistical

relationships, status and trends analyses, etc.

3. Assess and re-evaluate the monitoring network every 5 years for effectiveness in collecting relevant and pertinent data to assess nutrient reduction.

H. Establish and Document Data QA/AC.

Establish and document data QA/QC.

1. Ensure that all data quality objectives and Quality Assurance Project Plans are prepared and approved prior to initiating monitoring.
2. Conduct quality assurance and quality control protocols as part of field, laboratory, analysis, and modeling activities.

I. Design the Monitoring Program to Be Sustainable and Adaptable.

Design the monitoring program to be sustainable and adaptable.

1. Establish feedbacks with other project strategies to refine and improve the monitoring strategies and network as additional information becomes available.
2. Continually update the monitoring network as improved technology becomes available.
3. Integrate basin-wide monitoring networks.

PROVIDE INCENTIVES AND FUNDING

Provide Incentives and Funding

Leveraging funds from multiple sources should be a key component in implementing nutrient reduction strategies. One of the guiding principles of the *Governors' Action Plan II* is the use of innovative, market-based solutions for nutrient reductions. Economic incentives need to be created and identified to encourage voluntary implementation. Economic incentives are particularly important for the private sector, although recognition of performance and contributions to nutrient reductions are also important incentives. Economic incentives might include watershed- or basin-scale water quality or nutrient trading programs, wetland credits for treatment or marsh creation, and conservation easements.

Objective

Synthesize information on existing funding sources available in the Uplands for implementation of nutrient reduction strategies, and investigate alternative economic incentives to promote nutrient reduction.

A. Identify Existing Funding Resources

Identify existing funding sources for nutrient reduction implementation.

1. Review and document needed elements to reduce nutrients in Upland waterbodies (e.g., characterization, implementation, monitoring, and education).
2. Gather information on existing funding sources including:
   a. Funding Agency (federal, state agencies, non-governmental, private organizations);
   b. Authorization;
   c. Appropriation;
   d. Description;
   e. Eligibility;
   f. Matching fund requirements, if any;
   g. Application process and schedule for funding;
   h. Current status; and
   i. Web links and ancillary information.
3. Provide funding information to appropriate work groups and watershed implementation teams for use in submitting funding applications.
4. Investigate alternative funding sources existing in other states, such as:

a. Conservation Reserve and Enhancement Program (CREP), and

b. Nutrient trading programs (e.g., Florida, Ohio, Pennsylvania).

5. Emphasize existing funding programs and encourage participation and increased funding, e.g., Healthy Forest Reserve Program, Environmental Quality Incentives Program, Conservation Reserve Program, and Wetland Reserve Program.

6. Investigate modifications to existing state, federal, non-governmental, and private sources to create or enhance nutrient reduction activities in the Upland areas.

   a. Cluster Environmental Quality Incentives Program (EQIP) projects within watersheds to improve effectiveness of management practices to reduce nutrients.

   b. Joint funding of clustered Farm Services Agency, EQIP projects within watersheds.

   c. Integrate FSA loan programs with cost-share funding.

   d. Investigate Land Trust, TNC, Southern Companies programs for funding for preservation projects that also reduce nutrients.

7. Leverage project funds within watersheds to integrate in-field, edge of field, and instream management practices.

B. Investigate Incentive Merchanisms

Investigate the potential of incentives as a mechanism for implementing nutrient reduction.

1. Investigate alternative approaches for creating incentives – economic, social, and environmental – to reduce nutrients in Upland waterbodies (also Stakeholder Awareness, Outreach and Education) including but not limited to:

   a. Valuing ecosystem services, including wetlands for wastewater treatment;

   b. Establishing carbon credits system;

   c. Nutrient trading (point source/nonpoint source);

   d. Poultry litter transfer (on-going in the Upland counties) or use as an alternative energy source, (MS has a company that manufactures digesters for chicken litter to produce methane for heat and cogeneration of electricity);

e. Tax credits– See if additional tax credits could be provided for "green" development;

f. Value-added products– digester residue can be used to produce soil amendment and carbon filtration media;

g. USDA provides coupons for senior citizens to use at farmers markets. Promote the use of compost for produce growers and farms to encourage locally grown products (see Identity Management Practices).

2. Implement alternative approaches with potential application to Mississippi Upland watersheds.

a. Trees as a crop to provide riparian habitat, timber harvest, and hunting leases.

b. Green Star certification for businesses that reduce nutrient loading in point source or stormwater discharge. Create a "brand" for products, services, or companies that contribute to nutrient reduction.

c. Sustainable forestry certification for logs timbered using best forestry management practices and penalties for logs timbered from non-certified stands.

d. Develop equivalency between point and nonpoint source nutrient loads so that a net reduction in nutrient loading can be achieved through trading.

e. Create a reforestation tax incentive for non-forest land.

f. Promote reuse/recycling of treated wastewater or grey water within the seafood processing industry as rinse water.

g. Promote the use of treated wastewater for watering locally grown produce in clustered community areas and promote farmers markets for selling locally grown produce.

h. Foster an agricultural initiative campaign that emphasizes sustainable and safe food and fiber production, which includes nutrient management.

i. Incorporate reuse/recycling of stormwater runoff and irrigation return flow by golf courses.

COMMUNICATE RESULTS

Communicate Results

It is important to document the results from the implementation of nutrient management practices. Communicating successes to the appropriate audiences as clear, concise, and understandable messages helps engage stakeholders. Demonstrated successes from smaller-scale projects can build confidence in the program and lead to implementing larger scale management practices.

Objective

Inform stakeholders of the results of nutrient reduction activities.

Target messages and communications to specific audiences.

A. Target Messages and Communications to Specific Audiences.

1. Involve stakeholders in the process of crafting messages and selection of communication media to ensure the right message is being sent the right way to the right audience.
2. Identify key local "communicators" in the upland counties. These include not just those individuals who typically interact with the public (e.g., elected/appointed officials, celebrities), and who are trusted, but also those individuals at the point of contact with target audiences (e.g., salespersons at hardware stores nurseries, coopes, selling fertilizers, county agents working with procedures, professional developer associations for green infrastructure or low impact development, including retrofits).
3. Develop simple, clear and understandable messages that are memorable and communicate this message often.
4. Publicize local successes.
5. The message is more than reducing excess nutrients; it is improving the quality of life in the Uplands.

The correct communication medium is as important as the message.

B. The Correct Communication Medium Is as Important as the Message.

1. Develop and implement a strategic, organized plan for communication and use of each medium.
2. Use the appropriate medium for the target audience. For many individuals, the medium is the message (e.g., social network messaging versus newspaper).
3. Communicate often. Repetition reinforces the message. Use marketing procedure and practices to get the message out. Make it memorable, and action-oriented.
4. Go to where the target audience is, in the broadest sense. Target

homeowners, professional associations, social networks, outlets, marinas, recreational areas, etc.

5. Link the story or message to websites regularly visited by the target audience.

C. Identify Measures of Success that are Meaningful to the Audience and Easy to Communicate.

Identify measures of success that are meaningful to the audience and easy to communicate.

1. Communicate indicators or measures of success that have relevance and meaning for the target audience.
   a. Outputs are administrative or tactical actions that need to be implemented if an outcome is to be realized (See Table 1 for examples.).
   b. Outcomes are indicators or measures that indicate quantitative progress is being made toward attaining a goal or that the goal has been attained (See Table 1 for examples.).
   c. Endpoints are those measures or things about which people care because the measure has economic or social value (See Table 1 for examples.).
2. Progressively move from quantitative outputs to outcomes to endpoints as information becomes available. Communicate only those indicators that are important for your target audience. Other information in the message becomes noise.
3. Refine the endpoints as the economic and social benefits can be better quantified and greater insight is gained about what the target audience truly values.

Table 1. Mississippi Measures of Success Associated with Reducing Excess Nutrients

Source	Measured/ Monitored Information	Data Source	Reporting Entity	Output	Outcome	Endpoint	Temporal Response x Spatial Scale
NPS • Cropland • Forest • Pasture/ Open • Urban	-Pre/post WQ [sed., N, P] and Q -[Chl a] -Bluegr algae counts -Benthic organ. counts -Fish sp counts -Fish kills -Fertilizer applic. rates	-NWIS -FSA -ARS Sed Lab -MDEQ -enSPIRE -STORET -MDWFP -YMD	-USGS -NRCS -Delta F.A.R.M. -YMD -COE -MSU -ARS -MDWFP -MDEQ -EPA -MFC -Ag Ext.	-ac/ft BMPs impl. -ac affected -No. weirs installed -No. pre-post-monitor sites -Reduced str mi nut impaired -Reduced str mi sed impaired -Increased ac forest -increased ac CRP/ WRP -Reduced fertiliz. applic. rates -No. On-Farm Network partic. -ac restor. Wetlands -ac stream buffer	-Sed load reduc (tons/ac) -N load reduc (lbs/ac) -P load reduc (lbs/ac) % sed reduc % N reduc. % P reduc. -mi str attaining DU -ac lakes attaining DU - reduced HAB events -Increased M-BISQ score -Reduced fertiliz. application -Increased sportfish index score	-Improved Sport fishery -Improved rec. use -No drink water Taste/Odor prob. - Aesthetically appealing - No green scum -Increased wildlife habitat -Increased water fowl habitat -Greater abun. migratory songbirds and waterfowl	Intervention analysis on monitored data for response times at different spatial scales
Pt Source • Munic. • Indust. • Strmwtr	-Daily Q - [Sed, N, P] -Storm Q -DMRs	-EPA PCS -eDMR	-MDEQ	-No. NPDES permits wi N,P limits -Increased compliance	-Same as above	-Improved Sport fishery -Improved rec. use -No drink water Taste/Odor prob. - Aesthetically appealing - No green scum	Intervention analysis – fx of relative contribution to total load
Atmospheric • Point • Mobile	-NOx Emission est. -Wet N deposit - O_3 Conc.	-enSITE -NTN	-MDEQ -EPA NADP	-Decreased NOx permit limits -O_3 attainment	-Decreased atmos. N loads (lbs/ac/yr) -% N reduc.	-Increased visibility -Improved Air Qual.	Similar to Pt source analysis
Hydrology • SW	-Stage -Water table elev.	-YMD -MDEQ	-YMD -MDEQ	-No. metered wells -No. conserv. practices	-Increased water table elev.	-Sustainable streamflow	Response time analysis

Table 1. Continued.

Source	Measured/ Monitored Information	Data Source	Reporting Entity	Output	Outcome	Endpoint	Temporal Response x Spatial Scale
• GW	-Water use	-NWIS	-USGS	impl. -No. tailwater recovery sys. Impl.	-Increased irrigation eff.	-Sustainable groundwater	

IMPLEMENTATION

The ultimate goal is not to develop, but implement the Upland nutrient reduction strategies and reduce excess nutrients entering and preventing the attainment of desired uses by MS Upland streams and estuaries. This Upland nutrient reduction strategic plan will provide guidance for the development and implementation of watershed management plans in Upland watersheds that address nutrient reduction. The development and implementation of these Plans will occur through locally-led watershed implementation teams consisting of stakeholders interested in improving the water quality of streams and lakes in that watershed. The process of implementing watershed management plans follows the general flow diagram described in Figure 1 for the nutrient reduction strategies;

1. Characterize watersheds in the Upland area, determine which watersheds have nutrient TMDLs or "hot spots" with high nutrient loading per unit area, and which watersheds are currently attaining stream and lake designated use, and rank these in priority from those with the highest nutrient loading to the lowest. Characterize these watersheds based on historical trends and current status, as well as estimating nutrient loadings using appropriate analytical tools.
2. Target watersheds for restoration and/or protection, primarily based on the willingness of local stakeholders to implement restoration and protection management practices. Form a watershed implementation team.
3. Document the management programs, ordinances, regulations, policies that pertain to the targeted watershed. Working through the watershed implementation team, establish quantitative targets for reducing excess nutrients and identify suites of management practices that, when implemented, have a high likelihood of attaining these nutrient reduction targets.
4. Identify funding sources and (or create) economic incentives available to assist landowners (growers/producers, businesses, homeowners, etc.) in implementing the appropriate management practices.
5. Design and implement a monitoring network to document the effectiveness of these management practices in reducing nutrients and attaining the quantitative nutrient targets. Conduct pre-implementation monitoring to establish a reference before implementing the management practices and continue monitoring after the management practices have been implemented to document their effectiveness.

Implementation

The goal of this document is to implement nutrient reduction in the Mississippi Upland region.

The process for implementing the strategy follows the process for developing the strategy.

6. Develop watershed management plans. All watershed management plans will incorporate the US Environmentsl Protection Agency's 9 Elements of Watershed Protection. (http://www.epa.gov/owow/nps/watershed_handbook/pdf/ch02.pdf).
7. Compile and tell stories about the efforts individuals and businesses are making and the success they are achieving in improving the quality of life in the Mississippi Uplands by reducing excess nutrients. Let local champions, organizations and associations tell their story their way to their friends and associates, emphasizing the measures of success of value to their audiences.

Continue to move down (or up) the priority list from highest to lowest nutrient contributing watersheds, modifying and adapting the nutrient reduction strategies and management plans as lessons are learned that will improve the approach. Continue to create additional incentives and opportunities for reducing excess nutrients and telling the success stories.

PRACTICE ADAPTIVE MANAGEMENT

Practice Adaptive Management

Adaptive management, or learning by doing, is the preferred method for implementing the Mississippi Upland Nutrient Reduction Strategic Plan. However, there is currently a gap between the concept and actual implementation of adaptive management. Adaptive management implies that there is the potential for requiring increased reductions in the future. This can create uncertainty for stakeholders expending current funds to implement practices, because future reduction targets could require implementing different practices. The emphasis should be on doing the best with what is currently available, tracking progress, and modifying, if necessary in the future. Risk management is part of adaptive management.

1. Evaluate, assess, and modify, if necessary, the Upland Nutrient Reduction Strategic Plan and watershed management plans every 5 years.
2. Develop approaches for assessing the cumulative effectiveness of nutrient management practices in watersheds and potential lags in system response that need to be considered as part of the assessment.
3. Determine how uncertainty or risk will be included as part of adaptive management and the assessment process.
4. Determine and prioritize the science and technology questions that need to be addressed through study or research to assess the effectiveness of management practices over time.
5. Continue to document and quantify the monetary and non-monetary benefits associated with reducing excess nutrients to Upland streams and lakes.

EPA is in the process of recommending elements to be included in a state nutrient management framework. MDEQ is a co-lead on the Hypoxic Task Force and has been working closely with EPA. This Upland nutrient reduction strategic plan is expected to satisfy the recommendations in the state nutrient reduction management framework. However, if necessary, the strategic plan will be modified to incorporate any elements needed to satisfy the EPA recommendations.

Evaluation

Comparison of pre- and post-implementation monitoring data from these local watershed projects, as well as other assessment tools, will be used to provide a better understanding of what nutrient and sediment load reductions are achievable. The quantification of achievable nutrient and sediment load reductions and implementation costs, as well as environmental values using the concept of ecosystem services, will be performed to provide a better understanding of the costs and benefits of these watershed projects, and to calibrate/modify the nutrient reduction strategic plan, determine the appropriateness of TMDL load reduction targets, and provide useful information for the development of nutrient criteria. Documentation of these results will be an important product of this work, which can provide the information necessary to quantify estimates of potential nutrient reductions, costs, and values to stakeholders on a basin-wide or regional scale.

Periodically evaluate the results from nutrient management.

Adaptive management is one of the key components of the nutrient reduction strategic plan. An integrated assessment will be conducted every 5 years to assess the progress and document the lessons learned through the implementation process. Five years is considered adequate for observing near-field changes in water quality from the implementation of various management practices in the watershed. Two assessment periods should permit an assessment of far-field, downstream water quality changes. These analyses will include not only an assessment of what has been effective, but also what modifications are needed to improve the implementation practices and process. With the determination of what reductions are achievable, quantitative reduction targets can be established and future progress evaluated in relation to achieving these targets.

Adaptation

Adapt management based on the evaluation and changes in knowledge.