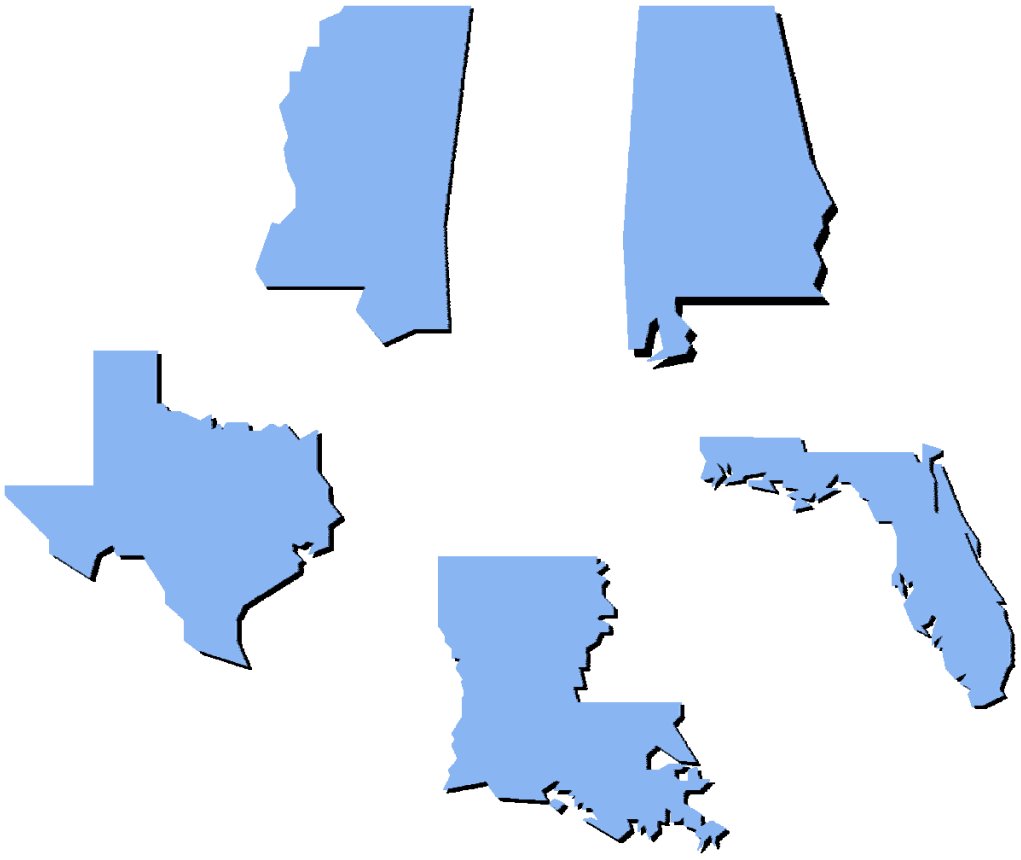
Coastal Nutrient Reduction Strategy Template



JANUARY 15, 2010

EXECUTIVE SUMMARY

The Mississippi River/Gulf of Mexico Hypoxia Task Force *Gulf Hypoxia Action Plan 2008 for Reducing, Mitigating, and Controlling Hypoxia in the Northern Gulf of Mexico and Improving Water Quality in the Mississippi River Basin* and the Gulf of Mexico Alliance (GOMA), *Governors' Action Plan II for Healthy and Resilient Coasts* both call for the development of state nutrient reduction strategies for those states with significant contributions of nitrogen and phosphorus to the Gulf.

Effective nutrient reduction strategies must be adaptable to a range of conditions and needs, with outreach to, and buy-in from, the appropriate stakeholders within each state. However, it is also desired to have compatible and comparable nutrient reduction strategies among all states, but particularly among the five Gulf coastal states that share the common Gulf of Mexico resource. One approach for achieving this desired outcome is to develop a template for Gulf coastal nutrient reduction strategies, with identical elements for all five states, but with the flexibility to accommodate differences among states.

This report describes a common template that can be used by GOMA states to guide the development of their respective state nutrient reduction strategies, which will be used to develop watershed-based nutrient reduction management plans for Gulf coastal watersheds. This template was developed through a workshop with the participation of a diverse group of stakeholders from the five GOMA states. This template is designed to support both the *Gulf Hypoxia Action Plan 2008* and the *Governors' Action Plan II* that call for the development of state nutrient reduction strategies. Implementation of this template will also provide the information necessary to evaluate these nutrient reduction strategies, calibrate future nutrient TMDLs, and support states as they consider appropriate nutrient criteria for coastal waters.

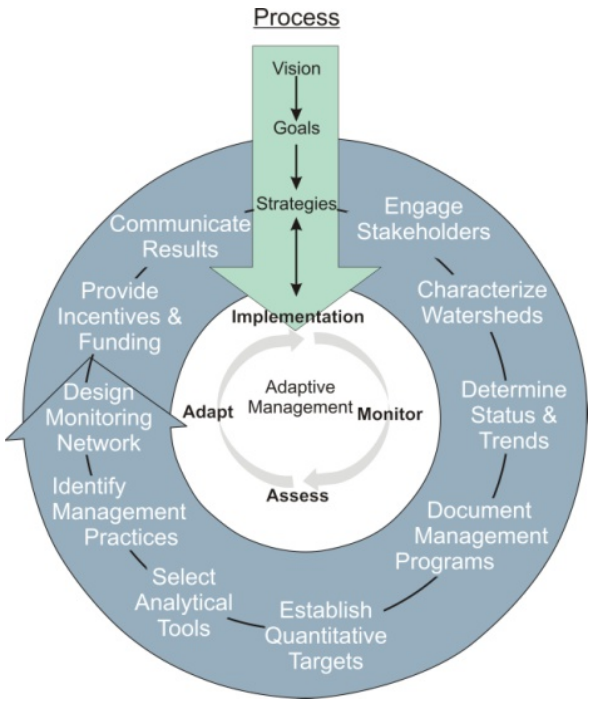


Figure E.1. Nutrient reduction strategy process.

The template process, shown on Figure E.1 and described in this report, begins with the vision and goals for nutrient reduction. Integrated, comprehensive nutrient reduction strategies can be developed by incorporating the eleven strategic elements discussed in this report, implemented through an adaptive management approach. In addition, the report includes a set of strategic questions for each element to help guide the process.

Having consistent, comparable approaches for developing nutrient reduction strategies provides:

1) more effective, comprehensive, and integrated approaches for addressing eutrophication and associated nutrient issues among coastal states;

2) a common vision and path forward for nutrient reduction strategies;

3) opportunities for leveraging state and federal resources in obtaining information useful to multiple coastal states;

4) improved collaboration and communication among states in designing and implementing nutrient reduction strategies; and

5) the opportunity to transfer this template to inland, non-GOMA states within the large river basins that drain to the Gulf of Mexico (e.g., Mississippi River, Mobile River, Rio Grande), improving the comparability of nutrient reduction strategies within these basins.

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Appendix A: The Coastal Nutrient Reduction Strategy Template Workshop

Appendix B: Summary of Coastal Issues in GOMA States

INTRODUCTION TO THE COASTAL NUTRIENT REDUCTION STRATEGY TEMPLATE

Effective nutrient reduction strategies must be adaptable enough to be used in watershed-based nutrient reduction plans addressing a wide range of conditions and scale, with outreach to, and buy-in from, the appropriate stakeholders within the state. It is desirable to have compatible and comparable nutrient reduction strategies among all states, but particularly among the five Gulf coastal states sharing the common Gulf of Mexico resource. One approach for achieving this outcome is to develop a template for Gulf coastal nutrient reduction strategies, with identical elements for all five states, but with the flexibility to accommodate differences among states and watersheds.

***Gulf Hypoxia Action Plan* and *Governors' Action Plan II* both call for state nutrient reduction strategies.**

Template Purposes

- This template is designed to support the Mississippi River/Gulf of Mexico Hypoxia Task Force *Gulf Hypoxia Action Plan 2008 for Reducing, Mitigating, and Controlling Hypoxia in the Northern Gulf of Mexico and Improving Water Quality in the Mississippi River Basin* (2008), and the Gulf of Mexico Alliance (GOMA) *Governor's Action Plan II for Healthy and Resilient Coasts 2009-2014* (2009), calling for development of state nutrient reduction strategies (see Appendix A).
- Implementation of this template will provide the information necessary to:
  - Develop state nutrient reduction strategies,
  - Calibrate future nutrient total maximum daily loads (TMDLs),
  - Support state efforts to develop appropriate nutrient criteria for coastal and estuarine waters for protection of aquatic resources and prevention of nutrient impairment, and
  - Contribute to developing watershed-based nutrient reduction plans.

This report provides a template that can be used by all GOMA states to develop these strategies.

How Did We Get Here?

- A Coastal Nutrient Reduction Strategy Template (CNRST) workshop was held to develop the template. Participants at the workshop represented a diverse group of stakeholders from the five GOMA states (Appendix A).
- Workshop discussions, summarized in Appendix A, were used to formulate the template and process for developing state coastal nutrient reduction strategies described below.

Intended Audience

The target audience for this template includes:

- State and federal agencies with the authority to develop and implement nutrient reduction plans and practices,
- Local agencies and organizations with a mission for environmental and water quality protection and restoration, and
- Private businesses and landowners with an interest in nutrient reduction and water quality improvement.

Template Foundation – Guiding Principles and Building Blocks

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

Guiding Principles

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

A number of building blocks on which to develop nutrient reduction strategies for Gulf coastal watersheds were identified for the template:

Building Blocks

1. Use collaborative, inclusive teams of stakeholders (i.e., governmental agencies, non-governmental organizations, academic, businesses, and agricultural producers) 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. Make strategic decisions on 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, including the Mississippi River drainage basin. 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 plan development and implementation that can be applied to small or regional watersheds, as well as at the basin level.

References

GOMA. 2009. Governor's Action Plan II for Healthy and Resilient Coasts, 2009-2014. Gulf of Mexico Alliance. Online at http://gulfofmexicoalliance.org/pdfs/dp2.final2.pdf

Mississippi River/Gulf of Mexico Watershed Nutrient Task Force. 2008. Gulf Hypoxia Action Plan 2008 for Reducing, Mitigating, and Controlling Hypoxia in the Northern Gulf of Mexico and Improving Water Quality in the Mississippi River Basin. Washington, DC. Online at http://www.epa.gov/msbasin/actionplan.htm#documents

PROCESS FOR USING THE TEMPLATE

The process of developing nutrient reduction strategies begins with a vision – a compelling picture of how nutrient reduction to coastal ecosystems contributes to an improved quality of life – environmentally, economically, and socially (Figure 1). This vision establishes the conditions to be achieved through the process of reducing nutrients to coastal ecosystems.

Vision – A healthy and resilient Gulf of Mexico Coast
(Governors' Action Plan)

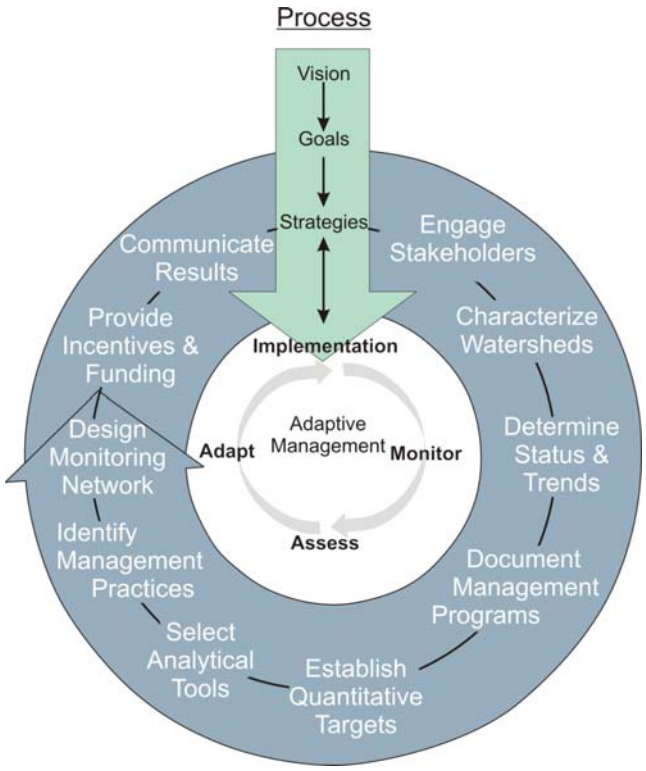

Figure 1. Template process for developing nutrient reduction strategies.

The next step is to establish SMART goals that will lead toward that vision (Figure 1). **SMART** goals are **S**pecific, **M**easurable, **A**ttainable, **R**ealistic, and **T**imely (i.e., have a time frame for attainment).

SMART Goals

The goal for the Gulf of Mexico Hypoxia Task Force is to reduce the zone of hypoxia in the northern Gulf of Mexico to 5,000 square kilometers. A long-term goal of the GOMA is to "establish a comprehensive ecosystem approach to manage nutrient inputs and reduce impacts to coastal ecosystems." However, each of the states will likely have their own complementary vision and goals for nutrient reduction within their borders, including a vision and goals for coastal watersheds.

Strategies provide the vehicle for attaining the goals. The ten strategic elements proposed for coastal nutrient reduction strategies, as defined in Appendix A and 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 elements are shown on Figure 1 reflects the suggested general order of priority for implementation. The workshop participants agreed that it made most sense to begin by engaging stakeholders, followed by watershed characterization, determining status and trends, documenting existing management programs, and establishing quantitative targets. Developing a coastal nutrient reduction strategy, however, is an iterative process that can be initiated through any of the strategic elements. Detailed discussions of all the strategic elements follow. These discussions include a set of questions to guide the information needs associated with each element.

Iterative Process

The two-way arrow between the strategies and the adaptive management cycles illustrates the iterative nature of the process. Once a strategy is developed and implemented, the results will be monitored and the strategy effectiveness assessed. At that point it may be judged prudent to re-visit the strategy cycle to modify the existing strategy based on what has been learned during implementation, monitoring, and assessment.

INVOLVE AND ENGAGE STAKEHOLDERS

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

Involve and Engage Stakeholders

An inclusive approach is critical, engaging stakeholders of different race, culture, 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 overlooked.

Successfully involving and engaging stakeholders can include:

Engaging Stakeholders Successfully

1. ***Finding common ground –*** For most issues, including nutrient reduction, there are some topics that are controversial, but there are also many that are not. Begin with topics for which there is agreement or common ground, build trust by addressing these, and, over time, begin addressing the more contentious topics. Establishing trusting relationships is absolutely essential and is a long-term process.
2. ***Conducting joint fact-finding and sharing resources –*** Creating shared ownership of nutrient management can be facilitated by having stakeholders engaged in the process beyond being asked to implement practices and change how they do things. Stakeholders can participate in identifying and prioritizing nutrient sources and targeting areas for implementation, as well as monitoring changes in water quality. Integrating stakeholder insight and information into the process of developing and implementing nutrient reduction strategies indicates you value their input, and gives stakeholders ownership of the process. This is an important part of building trust.
3. ***Understanding different perspectives –*** There are differences in the perspectives of urban and rural communities. In general, rural communities may have a greater sense of place, desire the flexibility to address nutrients their own way, and may have a closer connection with the environment. Urban communities may not have the same connection with the environment, and are more receptive to zoning or similar ordinances, and approaches like Smart Growth and green infrastructure for development. In addition, implementing management activities involves different levels of effort from these two populations; i.e., management in rural areas may involve stakeholders significantly changing how they do things, whereas the

only change required of an urban stakeholder may be to pay a higher utility bill.

4. ***Going where the stakeholders are –*** Go to the stakeholders rather than expect them to come to your meetings. Speaking at meetings of community groups, and participating in community events (e.g., fairs) can be effective methods for involving and engaging diverse stakeholders.
5. ***Institutionalizing relationships –*** All groups experience personnel turn-over. Methods for sustaining relationships with stakeholders, such as maintaining multiple points of contact within an organization, should be included in the strategy.
6. ***Public recognition –*** The opportunity for public recognition can be a strong incentive for companies, groups, and individuals to get involved in restoration and protection activities.
7. ***Planning celebrations –*** Stakeholder economic and recognition incentives are important, but so is celebrating successes. These celebrations need to be planned or they won't occur. The celebrations can be in the form of educational fairs or outings, celebration meals, prizes, give-aways, or other mementos or occasions. However it is done, celebrating success is important.

The following questions can guide the formulation of strategies for engaging stakeholders:

Strategic Questions

1. Which groups of stakeholders need to be engaged to reduce nutrients in coastal watersheds?
2. What do these and other stakeholders believe about their contributions to nutrient enrichment of streams in their watershed? To the Gulf of Mexico?
3. What outreach approaches would be effective for these stakeholders?
4. How do you get stakeholder buy-in to the approaches, costs and benefits associated with nutrient reductions?
5. Where do stakeholders get their environmental information? What are the sources they trust?
6. What perceptions do stakeholders have that differ from fact? What educational approaches might change the perceptions?
7. What stakeholder behaviors are important for nutrient reduction, and what is needed to encourage these behaviors?
8. What social marketing programs or approaches are needed for stakeholders to reduce nutrient loads?
9. Are there key stakeholders that can influence the process more than others?
10. How will we deal with critical stakeholders that are uncooperative?

CHARACTERIZE COASTAL WATERSHEDS, IDENTIFY SOURCES, AND PRIORITIZE SITES

This element includes delineating the coastal watershed that will be addressed by the strategy (see discussion of delineation of coastal watersheds in Appendix A).

This element also includes determining the attributes or characteristics of the watershed, such as topography, soil types, land use/land cover, impervious area, water body types, nutrient loads, nutrient sources, and stakeholder interest and willingness to participate. Characterizing current conditions provides a baseline against which effects from restoration and protection activities can be assessed. Having consistent land use coverage and classification methodologies would contribute to comparable characterization approaches among states, regardless of the scale of the management unit selected for implementation. A consistent method for identifying major sources of and estimating and apportioning nutrient loads that could be used by all GOMA states is needed to increase consistency.

Characterize Coastal Watersheds, Identify Sources, and Prioritize Sites

In addition to current conditions, past and projected future conditions of the watershed should also be characterized. Past conditions can indicate areas where legacy nutrient sources might be expected and can also be used to develop reduction targets. Management activities designed based on past or current conditions can be rendered ineffective by future land use/land cover changes in the watershed. Considering projected future changes in land use/land cover and population can better ensure management success.

This element also includes prioritizing areas for nutrient-related restoration and protection activities. Prioritization will consider:

- Where water quality needs to be protected, and where it needs to be restored;
- Where success (as defined for the project or system) can be achieved relatively quickly, to maintain enthusiasm;
- Where it is important to start now, because it is likely to take a long time to see results;
- Where implementation will result in the largest impact, to maintain enthusiasm;
- Where there is the opportunity for value-added activities, such as recreation or ecotourism;

- Where there are local champions and people ready to act; and
- Where success will create local champions.

The following questions can guide the formulation of strategies for characterizing watersheds and nutrient sources, and prioritizing implementation of management practices:

1. What planning efforts have been completed within the watershed?
2. Where are the "hot spots" for nutrient runoff in coastal watersheds and what are their characteristics?
3. What are the sources of the nutrients in the watershed?
4. What proportion do various sources, such as atmospheric deposition, contribute to nutrient loads?
5. Where are sites with the lowest nutrient concentrations or loads and what are their characteristics?
6. What future changes are expected in watershed land use/land cover and nutrient loadings to coastal waters?
7. What are economic and ecological values of various areas within the watershed (forests, agricultural crops, greenways, recreation, ecotourism)?
8. What process and criteria should be used to prioritize and target sites for the implementation of traditional and innovative management practices?

Strategic Questions

DOCUMENT CURRENT STATUS AND HISTORICAL TRENDS IN COASTAL SYSTEMS

To assess the effectiveness of reduction strategies, the current level of nutrient loads and impacts must be documented 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 coastal ecosystems.

This strategic element can also include identifying any case studies that could help direct the implementation of nutrient management practices.

Document Current Status and Historical Trends in Coastal Systems

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.

The following questions can guide the documentation of current status and historical trends:

Strategic Questions

1. What water quality monitoring stations are available in coastal watersheds, how long is their period of record, and what kinds of historical nutrient loading trends are indicated?
2. What biological metrics were monitored at these sites and what effects of nutrient enrichment have been observed?
3. What is a reasonable period of historical record for assessing trends in coastal watersheds and in what waterbodies do these records exist?
4. What case studies demonstrate the effectiveness of various management practices in reducing nutrients? What practices were implemented?

DOCUMENT REGULATIONS, POLICIES, MANAGEMENT PROGRAMS, AND PLANNING AREAS

Document Regulations, Policies, Management Programs, and Planning Areas

Reviewing and documenting existing regulations, policies, management programs and planning areas not only helps to identify and bound authorities, options and alternatives for reducing nutrients, but also helps identify opportunities for leveraging with other programs to reduce nutrient loads. For example, atmospheric pollutants are regulated through air, not water programs, but atmospheric transformation of nitrogen oxide emissions contributes to significant nitrogen deposition into coastal systems. Atmospheric deposition can contribute over 50% of the total nitrogen load to some Gulf of Mexico estuaries. Therefore, leveraging management activities with air programs can reduce estuarine nitrogen loadings. As another example, coastal use permitting programs, such as exist in Louisiana, can be used to encourage or require implementation of BMPs in coastal areas.

The following questions can guide documentation of existing regulations, policies, management programs and planning areas in coastal watersheds:

Strategic Questions

1. What management and regulatory programs, and policies, are in place or apply within the watershed and where?
2. What planning efforts have been completed within the watershed?
3. What are the management units for regulations, policies, planning efforts and management programs in the watershed?
4. What new regulations, management programs, and/or planning areas could be proposed or championed to provide new alternatives that better reduce nutrient loads?

ESTABLISH QUANTITATIVE NUTRIENT REDUCTION TARGETS

Establish Quantitative Nutrient Reduction Targets

Quantitative nutrient reduction targets are essential to the adaptive management process of the strategy because the targets make it possible to track progress over time. Ultimately, numeric nutrient criteria are expected to provide targets 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 by each of the GOMA states. Until these criteria are finalized and promulgated, numeric targets can be established based on TMDL target reductions, historic or current nutrient loads (as in the Tampa Bay watershed where the nutrient load reduction target has been set based on loads from 2003 through 2007), or what is achievable with available methods and budgets.

The following questions can guide the formulation of quantitative nutrient reduction targets for the strategy:

Strategic Questions

1. What nutrient reductions are desirable?
2. What nutrient reductions are achievable?
3. What nutrient reduction targets were established through TMDL studies?
4. What phased approach is proposed to move toward quantitative nutrient reduction targets?
5. When promulgated, what nutrient reductions are required to achieve numeric nutrient criteria?
6. What nutrient levels ensure full protection of aquatic resources in coastal estuaries and their watersheds?

EVALUATE AND SELECT APPROPRIATE ANALYTICAL TOOLS

Evaluate and Select Appropriate Analytical Tools

Numerous tools are available for estimating and assessing potential nutrient reductions from different management practices, and benefits to water quality. It is important to identify which of these tools are applicable for coastal ecosystems and watersheds, and document the associated assumptions, inputs and output results. If similar tools were used by all GOMA states, there could be greater comparability among nutrient loading estimates, source apportionment, and nutrient load reduction targets. Modifying the SPARROW model (Robertson et al. 2009, Preston et al. 2009) for comparable nutrient loading projections in watersheds east and west of the Mississippi River represents an important step in providing a consistent tool to all of the GOMA states.

The following questions can guide evaluation and selection of appropriate analytical tools:

Strategic Questions

1. Which tools have a proven track record of predicting water quality changes in coastal watersheds, and waterbodies in response to management practices?
2. What other tools would be useful for assessing nutrient reductions through management in addition to computer or mathematical models?
3. What tools need to be improved or developed to evaluate the effects, costs, and benefits of nutrient reduction and management practices?
4. What are the uncertainties associated with each tool and can these uncertainties be reduced by using multiple tools? If so, how?
5. How much expertise and experience is needed to use and interpret the output from these various tools?

References

Robertson, D.M., G.E. Schwarz, D.A. Saad, R.B. Alexander. 2009. Incorporating uncertainty into the ranking of SPARROW model nutrient yields from Mississippi/Atchafalaya River basin watersheds. *Journal of the American Water Resources Association* 45(2): 534-549.

Preston, S.D., R.B. Alexander, M.D. Woodside, P.A. Hamilton. 2009. *SPARROW Modelling – Enhancing Understanding of the Nation's Water Quality* [Fact Sheet 2009-3019]. US Geological Survey.

IDENTIFY MANAGEMENT PRACTICES APPLICABLE FOR COASTAL WATERSHEDS AND RECEIVING WATERBODIES

Identify Management Practices Applicable for Coastal Watersheds and Receiving Waterbodies

Numerous management practices for both point and nonpoint sources have been implemented to reduce nutrient concentrations and loadings. In many instances, however, the effectiveness of these management practices has not been documented. In addition, sediment removal effectiveness of some BMPs has been equated with nutrient reduction effectiveness or efficiency without confirmation. Further, management practices should consider not just the traditional point and nonpoint 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 strategic element must be 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 are 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. Benefits also 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 considered.

As stated in the Guiding Principles, 'innovative and market-based' management practices should be identified. A range of practices beyond the traditional point and nonpoint source management practices can be used to reduce nutrient loads, including programs for recognizing industries, businesses, and agricultural enterprises for voluntary pollution prevention; regulations for emission of nitrogen gases; watershed- or basin-based nutrient trading programs; and water and input management practices.

Sharing information (e.g., effectiveness, costs and benefits) on management practices applicable for coastal watersheds would be beneficial for all the GOMA states and contribute to increased collaboration and comparability among states.

The following questions can guide identification of management practices applicable for coastal watersheds:

1. What management practices are applicable for the various land cover/uses in coastal watersheds and how effective are they?

2. What are the costs associated with implementing these management practices? Capital costs? Installation costs? Operation and maintenance costs?
3. How do you fully value the benefits associated with these management practices, including the benefits derived from ecosystem services?
4. How can communities better plan to reduce nutrients?
5. What management practices are applicable for phosphorus reductions? Nitrogen reductions? Both?
6. What pollution prevention practices should be considered for nutrient reduction?
7. Can we anticipate any unintended consequences, and how can we plan for them?

Strategic Questions

DESIGN EFFECTIVE MONITORING PROGRAMS

Design Effective Monitoring Programs

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 baselines, 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 baseline nutrient conditions and track changes resulting from management. 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, when, where, and how frequently 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.

The following questions can guide the design of effective monitoring programs:

Strategic Questions

1. If one of the strategies is to document the nutrient reductions that occur from the implementation of management practices, what general guidance do we need to provide to document these reductions?
2. What resources are needed to monitor nutrient reductions? Monetary and personnel?
3. What political barriers exist for implementing and maintaining monitoring networks over time?
4. Given year-to-year hydrologic variability, what duration of pre-implementation monitoring do we need to establish a baseline?
5. What biological or ecological endpoints should be monitored to demonstrate the effects of nutrient reduction?

6. What other constituents should be monitored to demonstrate whether management practices are contributing to nutrient reduction?
7. What constitutes, and how do you implement, representative monitoring networks?
8. What duration of post-implementation monitoring do we need to document the effect of management activities?
9. How will monitoring results be shared?
10. How can you use monitoring to identify the best technologies for reducing nutrient loading?

IDENTIFY AND CREATE ECONOMIC INCENTIVES AND FUNDING SOURCES

Identify and Create Economic Incentives and Funding Sources

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.

The following questions can guide identification and creation of economic incentives and funding sources for strategy implementation:

Strategic Questions

1. What programs and funding sources are available for management practices that might reduce nutrient inputs in coastal watersheds?
2. What matching funds are required for each of these programs and sources?
3. Where can additional funds and benefits be obtained by leveraging other programs, projects, or organization efforts with nutrient reduction practices?
4. What incentives have other states used to encourage voluntary implementation of management practices?
5. What incentives would encourage implementation of nutrient reduction practices by different end-users?
6. How do you effectively communicate these incentives to different stakeholder groups?
7. Which agencies need to be involved in working together to leverage funds and identify additional possibilities for funding?

DOCUMENT AND COMMUNICATE THE RESULTS

Document and Communicate the 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.

Communication among Gulf coastal states will also be an important part of this element. The need for information and data sharing among the states was identified during the workshop. Information that could be shared includes information about what practices worked and didn't work, and progress on strategy development, nutrient criteria development, and implementation of nutrient reduction management practices.

The following questions can guide planning for documentation and communication of results:

Strategic Questions

1. What type and quantity of information is needed to document the success of management practices in reducing nutrients from coastal watersheds?
2. How do you demonstrate success with natural lags in ecosystem responsiveness to management practices?
3. How much funding has been included for outreach, communication, and education?
4. What mediums are effective for communicating with which types of stakeholder audiences?
5. Who should communicate these messages to different stakeholder audiences?

PRACTICE ADAPTIVE MANAGEMENT

Practice Adaptive Management

Adaptive management, or learning by doing, is the preferred method for implementing nutrient reduction strategies. Adaptive management was recognized as being necessary by all the GOMA states, but there was also acknowledgement that 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. Having additional information on adaptive management would be beneficial for all GOMA states and stakeholders.

The following questions can guide planning for adaptive management:

Strategic Questions

1. What are reasonable periods for evaluating, assessing and modifying nutrient management practices, if needed? Three-year, five-year, ten-year cycles?
2. Are there events or situations that would require evaluation, etc. before scheduled in the cycle? How will they be handled?
3. Can conditions that will necessitate adaptation be specified as thresholds? How does adaptation feed back into the strategies loop?
4. How should the cumulative effectiveness of nutrient management practices in watersheds be assessed?
5. What degree of uncertainty is created or reduced by implementing management practices through adaptive management?
6. What improved efficiencies and reduced operation and maintenance costs should be tracked over time?
7. How can this template be implemented in other areas and non-coastal states?
8. In the assessment phase, are there science questions that need to be addressed through study or research? If so, can funding agencies that will support that work be identified?

A COMMON TEMPLATE

Having consistent, comparable approaches for developing nutrient reduction strategies permits:

1. More effective, comprehensive, and integrated approaches for addressing eutrophication and associated nutrient issues among coastal states;
2. Common vision and path forward for nutrient reduction strategies;
3. Leveraging of state and federal resources in obtaining information useful to multiple coastal states;
4. Improved collaboration and communication among states in designing and implementing nutrient reduction strategies; and
5. Potential transfer of the frame to other, non-GOMA states within the large river basins that drain to the Gulf of Mexico (e.g., Mississippi River, Mobile Bay, Rio Grande), improving the comparability of nutrient reductions strategies within these basins.

PATH FORWARD (NEXT STEPS)

The common template, described above, focuses on the development of nutrient reduction strategies by the five GOMA states. While the initial emphasis is on Gulf coastal states, the template is applicable for the development of any state nutrient strategy. The suggested next steps, therefore, are:

1. Distribute the template for wider review, comment, and possible implementation by other states. These comments would be incorporated into the template document, uploaded to the NOAA, EPA, and GOMA websites, and distributed for consideration by all interested states.
2. Form a coastal stakeholder team. Provide this team with background on the template and the problems and issues under consideration. Ask them to review the template and initiate the development of nutrient reduction strategies for coastal watersheds. Participants at the workshop should serve as the champions for the development of these coastal nutrient reduction strategies. The champions do not need to lead the team, but they should ensure the team is formed and a leader selected by the team. The stakeholder team should be inclusive, with members reflecting a cross-section of the community, including local governments, resource and regulatory agencies, non-governmental organizations, and private sector businesses and industry.
3. Establish a page on the GOMA website for use by GOMA coastal states. States can discuss their progress in using the template to develop nutrient reduction strategies, describe the members of their stakeholder teams and what each member brings to the team, provide lessons learned on using the template, identify available sources of common information needed by all coastal states, raise critical needs throughout the process, and track the progress of each of the coastal states in developing coastal nutrient reduction strategies.
4. Look for opportunities to leverage resources, information, and funds among GOMA coastal states and coastal watersheds. Federal agencies, and many non-governmental organizations transcend state boundaries and may be able to create economies of scale that benefit multiple states.
5. Start the process! The template has been developed. There is no reason to delay the development of coastal nutrient reduction strategies and begin implementing these within priority, targeted watersheds.

Appendix A:

Coastal Nutrient Reduction Strategy Template Workshop

Workshop Participants and Affiliations

Phil Bass, EPA Gulf of Mexico Program

Laura Beiser, Mississippi Department of Environmental Quality

Clyde Bohmfalk, Texas Commission on Environmental Quality

Jan Boydstun, Louisiana Department of Environmental Quality

Robin Burns, National Oceanic and Atmospheric Administration

Lael Butler, EPA Gulf of Mexico Program

Kim Caviness, Mississippi Department of Environmental Quality

Ryan Cole, Marathon Petroleum

Trey Cooke, Delta Farmers Advocating Resource Management (F.A.R.M.)

Nick Gatian, Mississippi Department of Environmental Quality

Amy Gohres, Weeks Bay Foundation

Richard Ingram, Mississippi Department of Environmental Quality

Charles Killebrew, Louisiana Office of Coastal Protection and Restoration

Valerie Kleinschmidt, Dauphin Island Sea Lab

Charles Kovach, Florida Department of Environmental Protection

Larry McKinney, Texas A&M University, Corpus Christi

Brian Miller, Illinois/Indiana Sea Grant Program

Ray Montgomery, Mississippi Department of Environmental Quality

Mickey Plunkett, United States Geological Survey

Ann Porter, Mississippi Department of Environmental Quality

Paul Rodrigue, USDA Natural Resource Conservation Service

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Lynn Sisk, Alabama Department of Environmental Management

LaDon Swann, Auburn University

Jennifer Weber, Alabama Department of Environmental Management

Lee Yokel, Alabama Dauphin Island Sea Lab

INTRODUCTION

Gulf coastal states share a common, contiguous ecosystem – the Gulf of Mexico – with a common problem: eutrophication. State and federal resource agencies and organizations have been working through national, regional, and local forums and programs to address this problem.

In June 2008, the Mississippi River/Gulf of Mexico Hypoxia Task Force released the *Gulf Hypoxia Action Plan 2008 for Reducing, Mitigating, and Controlling Hypoxia in the Northern Gulf of Mexico and Improving Water Quality in the Mississippi River Basin*[1]. The task force, led by the US Environmental Protection Agency (EPA), consists of state environmental and agricultural agencies 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* (GHAP) calls for the development of state nutrient reduction strategies for those states with significant contributions of nitrogen and phosphorus to the Gulf.

An organization of Gulf coastal states, the Gulf of Mexico Alliance (GOMA), developed the *Governors' Action Plan for Healthy and Resilient Coasts* in 2006[2]. This three-year plan also included a priority focus on reducing nutrient inputs to coastal ecosystems. A succeeding five-year *Governors' Action Plan II* was released in June 2009[3]. Planned actions of GOMA's Nutrient Reduction Priority Issues Team (PIT), led by Mississippi Department of Environmental Quality (MDEQ), include such priorities as the characterization of nutrient impacts, such as eutrophication and hypoxia, to coastal ecosystems; development and implementation of an aligned nutrient reduction strategy among the states for coastal watersheds; and the development of management tools to reduce excess nutrient inputs. The plan also calls for coordination of activities, where appropriate, with the GHAP. The focuses of GOMA's Nutrient Reduction PIT include (a) nutrient characterization, (b) nutrient criteria development, (c) hypoxia, and (d) nutrient reduction strategies.

Effective nutrient reduction strategies must be adaptable to a range of conditions and needs, with outreach to, and buy-in from, the appropriate stakeholders within each state. However, it is also desirable to have compatible and comparable nutrient reduction strategies among the five Gulf coastal states. One approach for achieving this desired outcome is to develop a template for Gulf coastal nutrient reduction strategies, with identical elements for all five states, but with the flexibility to accommodate differences among states. This template would be designed to support both the *Gulf Hypoxia Action Plan* and the *Governors' Action Plan II* that call for the development of state nutrient strategies. Implementation of this template would also provide the information necessary to evaluate these nutrient reduction strategies, calibrate future nutrient total maximum daily loads (TMDLs), and support states as they consider appropriate nutrient criteria for coastal waters.

[1] http://www.epa.gov/msbasin/actionplan.htm#documents
[2] http://www.gulfofmexicoalliance.org/gulfactionplan.final.pdf
[3] http://www.gulfofmexicoalliance.org/pdfs/ap2_final2.pdf

APPROACH

A Coastal Nutrient Reduction Strategy Template (CNRST) workshop was held on September 28 and 29 at the Five Rivers Conference Center in Spanish Fort, Alabama, to develop this template. The workshop agenda is included at the end of this report. Participants at the workshop represented a diverse group of stakeholders from the five GOMA states (see template). Workshop discussions were used to formulate a template and process for developing state nutrient reduction strategies. These discussions were wide-ranging, including the following topics:

1. Guiding principles and building blocks which provide the foundation for the template (see template);
2. Delineation of coastal watersheds;
3. Common issues and ongoing approaches among the GOMA states;
4. Strategic elements of an integrated, comprehensive nutrient reduction strategy;
5. Questions to guide the development of the nutrient reduction strategies and implementation plans; and
6. Engaging stakeholders throughout the process.

Delineating Coastal Watersheds

Determining and delineating a common management unit for coastal watersheds can facilitate the development of consistent and comparable nutrient reduction strategies for GOMA states. There are currently several categorical delineations of coastal watersheds in use along the Gulf, including:

1. NOAA Coastal Drainage Areas.
2. EPA Estuarine Drainage Areas.
3. Coastal Zone Management Areas.
4. USGS 12 digit hydrologic unit codes (HUCs) for coastal watersheds.
5. Coastal Nonpoint Source Program boundaries.
6. State river basin management units.

Some of these, such as the Coastal Nonpoint Source Program boundaries, are defined the same way in all five GOMA states. In other cases, different management delineations have been used in each state to accommodate differences in their coastal programs. Having a unified scheme or frame for delineating coastal watersheds, including consistent estimates of nutrient source apportionment and nutrient loads from coastal watersheds would be advantageous. It would also be useful to compare and evaluate the different coastal watershed delineations currently being used, as well as identify common elements for developing this unified frame for delineating coastal watersheds. In the near term, it is unlikely that a common frame will emerge

because different state projects and programs have different time and space scales of concern for coastal watersheds.

Four factors, however, are proposed to assist each state in delineating management units to be considered in reducing nutrients to coastal waters:

1. Areas of influence (where the state has influence to reduce nutrients);
2. Areas of priority (both for protection and reduction/restoration);
3. Partnerships formed and in place; and
4. Cooperative agreements with other agencies, organizations, or states needed to reduce nutrients.

There was considerable discussion on how the delivery of nutrients might affect the determination of appropriate coastal watershed boundaries. A distinction was made between the delivery of nutrients to the coast (e.g., individual state coves, bays, and estuaries), and the delivery of nutrients to coastal waters (e.g., the Gulf of Mexico). The former—delivery of nutrients to the coast—might result in the initial management unit being smaller coastal catchments or watershed areas because the contribution of local nutrient sources is a high priority. Delivery of nutrients to coastal waters might result in the initial management unit being a river basin because sources further upstream in the drainage basin are a high priority. This is not an either-or choice; reduction of both sources will be important over time. The issue is which primary nutrient sources will be addressed first, which in part defines the initial scale of a coastal watershed management unit. One of the building blocks for the template is recognition of the importance of multiple time and space scales in formulating nutrient reduction strategies.

It was ultimately decided that this template should be generic and applicable for any state or regional watershed, river basin, or major drainage region. Delineations of the appropriate management units are required, but these delineations and the underlying prioritization will be needed whether it's a coastal watershed in Louisiana, a river basin in Texas, a delta watershed in Mississippi or an interior watershed in Florida.

Common GOMA State Issues and Approaches

Prior to the workshop, a summary of coastal issues for each GOMA state, as well as their approaches for addressing these issues, was provided to the invitees (included as Appendix B to the template). While some issues had higher visibility in some states, there were a number of common issues among all the GOMA states:

1. ***Atmospheric nitrogen deposition –*** It is estimated that Gulf of Mexico estuaries and coastal waters receive anywhere from 10% to over 50% of their total nitrogen loading from atmospheric deposition. This is an issue where leveraging programs and treatment processes to reduce other atmospheric contaminants, such as mercury or greenhouse gas emissions, might also reduce atmospheric nitrogen deposition to estuaries and coastal waters.

2. ***Stormwater discharges into coastal waters*** – Many stormwater management practices focus on reducing sediment rather than nutrients.

3. ***The completion and implementation of TMDLs –*** These TMDLs can provide nutrient reduction targets.

4. ***Adequate monitoring networks –*** Monitoring sites and networks are needed to estimate nutrient loads to coastal systems, assess the effectiveness of implemented management practices, and assess long-term trends in water quality.

5. ***Wastewater NPDES limits –*** NPDES permits have emphasized phosphorus reduction rather than nitrogen reduction. Treatment processes typically have emphasized reducing the oxygen demand from ammonia by oxidizing ammonia to nitrate and discharging nitrate but have not limited the discharge of nitrogen into coastal waters.

6. ***Urban development in coastal watersheds –*** Increased development in coastal watersheds is contributing to increased nutrient loading to coastal waters. Zoning and ordinances on growth have not been adopted in many ex-urban areas.

7. ***Numeric nutrient criteria –*** All the GOMA states are currently developing numeric nutrient criteria, with estuarine systems typically being the last systems scheduled for development.

8. ***Equivalent tools –*** Different tools and models are being used by states so it is difficult to compare estimates of nutrient inputs, source apportionment, and characterization of watershed attributes and sources among coastal states. SPARROW model projections of nutrient loadings for watersheds east and west of the Mississippi River are in the process of being combined, which should provide one consistent base for estimating nutrient loadings to coastal waters.

9. ***BMP effectiveness –*** The effectiveness of a variety of BMPS is unknown, particularly when multiple BMPs are implemented within a watershed. Effectiveness of BMPs has generally been estimated for sediment rather than nutrient reduction.

10. ***BMP costs and benefits –*** The costs of implementing effective clusters of BMPs are also unknown. In addition, the valuation of the benefits from these BMPs is unknown.

11. ***Wetland loss –*** Loss of wetland habitat is occurring across the entire Gulf of Mexico region.

There are also several approaches that most, if not all, GOMA states are using to address nutrient issues:

1. ***Using wetlands to reduce nutrients in both nonpoint runoff and point source discharges –*** There are three potential benefits of using the natural transformation of nutrients by wetland systems to reduce nutrient loads to coastal waters: 1) wetland plants take up the nutrients and reduce nutrient concentrations in the water; 2) nutrients stimulate plant growth, which can contribute to land building and increased coastal habitat; and 3) wetlands can also increase groundwater recharge from surface water sources.

2. ***Implementing Environmental Leadership Programs for pollution prevention –*** Most of the GOMA states have created voluntary partnerships among industry, environmental organizations, and state agencies to reduce pollutants, including nutrients.

3. ***Doing the right thing –*** Every state also has programs, such as the Master Gardener program implemented through the Cooperative Extension Service, that emphasize proper use of fertilizers by individual homeowners.

4. ***Educational programs –*** Outreach and education programs have been developed by all the GOMA states, to not only increase understanding, but also to increase awareness of coastal nutrient issues, and to change behaviors in nutrient management through social marketing.

5. ***Modeling –*** Models have been used in every state to estimate nutrient loading from various watersheds. The modeling approaches, however, are not equivalent among states.

STRATEGIC ELEMENTS

Eleven elements of nutrient reduction strategies emerged from discussions among workshop participants. The strategic elements are listed in a general order of priority. While the process is highly iterative and can be initiated using any of the elements, workshop participants agreed that the process should be initiated using one of the first five elements. Each of the elements is described below.

1. ***Involve and Engage Stakeholders –*** Stakeholder involvement is essential to strategy success. Involving and engaging stakeholders early in the process, therefore, is critical.

2. ***Characterize Coastal Watersheds, Identify Sources, and Prioritize Sites –*** This element provides information on the issues and conditions that must be addressed in the strategy. This element includes delineating the area of focus (i.e., deciding what 'coastal watershed' will mean in the context of the strategy); determining characteristics of the watershed (e.g., topography, soil types, land use/land cover, impervious area, nutrient loads, and stakeholder interest and willingness to volunteer) in the present, past, and future; identifying the sources contributing to the watershed nutrient loads; identifying unique watershed characteristics that could serve as the basis of eco-tourism or other value-added activities; and setting priorities for implementation of water quality protection and restoration (i.e., nutrient reduction) activities in the watershed.

3. ***Document Current Status and Historical Trends in Coastal Systems –*** This strategic element might include not only determining the current status and historical water quality trends of various waterbodies, but also identifying any case studies that could help direct the implementation of nutrient management practices.

4. ***Document Regulations, Policies, Management Programs, and Planning Areas –*** Reviewing and documenting existing regulations, policies, management programs and planning areas helps to identify and bound authorities, options and alternatives for reducing nutrients; and identify opportunities for leveraging with other programs to reduce nutrient loads.

5. ***Establish Quantitative Nutrient Reduction Targets –*** Quantitative nutrient reduction targets are used to track progress and identify success.

6. ***Evaluate and Select Appropriate Analytical Tools –*** Numerous tools are available for estimating and assessing potential nutrient reductions from different management practices. In this element, tools appropriate for use in coastal watersheds are identified.

7. ***Identify Management Practices Applicable for Coastal Watersheds and Receiving Waterbodies –*** Numerous management practices for both point and nonpoint sources have been implemented to reduce nutrient concentrations and loadings. In this element, practices applicable for coastal watersheds, both traditional and innovative, are identified and characterized with respect to effectiveness, costs, and benefits.

8. ***Design Effective Monitoring Programs –*** Adequate data to support nutrient reduction efforts is essential. In this element, a plan for representative monitoring that provides essential data is developed.

9. ***Identify and Create Economic Incentives and Funding Sources –*** Leveraging funds from multiple sources should be a key component in implementing nutrient reduction strategies, including education and outreach and BMP maintenance. Economic incentives need to be created and identified for voluntary implementation. This may involve working to modify restrictions associated with existing funding sources, e.g., the restriction that federal grant money can't be used for monitoring programs.

10. ***Document and Communicate the Results –*** To maintain momentum in the nutrient reduction effort, successes need to be documented and communicated to appropriate audiences as clear, concise, and understandable messages.

11. ***Practice Adaptive Management –*** Adaptive management, or learning by doing, allows work in nutrient reduction to move forward despite gaps in knowledge that increase uncertainty of results, by providing a process for modifying management as results become apparent and knowledge improves.

Formulation of these eleven strategic elements as part of state nutrient reduction strategies is a highly interactive and iterative process. This can be illustrated by highlighting the discussion that occurred at the workshop on involving and engaging stakeholders.

ITERATIVE, INTERACTIVE STRATEGIES

Watershed management, including nutrient reduction, is fundamentally a social activity. While point source nutrient reductions are primarily regulatory-driven, nonpoint source nutrient reductions are primarily voluntary. Regardless of the source, involving and engaging stakeholders early in the process is advantageous. Louisiana, for example, implemented a voluntary Environmental Leadership Program for point source dischargers to move beyond compliance with NPDES and receive recognition for voluntary pollution prevention programs. Agricultural producers in Mississippi are participating in the development of nutrient reduction strategies in the Delta because they prefer self-regulation. Similarly, Tampa Bay created a Nitrogen Management Consortium that fosters partnerships outside a regulatory framework because self-regulation was preferred over government promulgated regulation. This Nitrogen

Management Consortium helped establish the quantitative nutrient load target for Tampa Bay. The Consortium agreed to the need to "hold the line," maintaining nitrogen concentrations at the average levels observed during the 2003-2007 period.

One approach for identifying which stakeholders or stakeholder groups to involve and engage is through watershed characterization, by looking at a watershed land use/land cover map (Figure 1). This land use/land cover map reflects the cumulative social choices individuals, communities, and organizations have made about the uses of their property that are important to them. Detailed land use categories can help ensure stakeholder involvement is as inclusive as possible by identifying additional stakeholder groups such as citrus and sugar cane growers, commercial and residential developers, wetland or lake associations, and wildlife refuge managers.

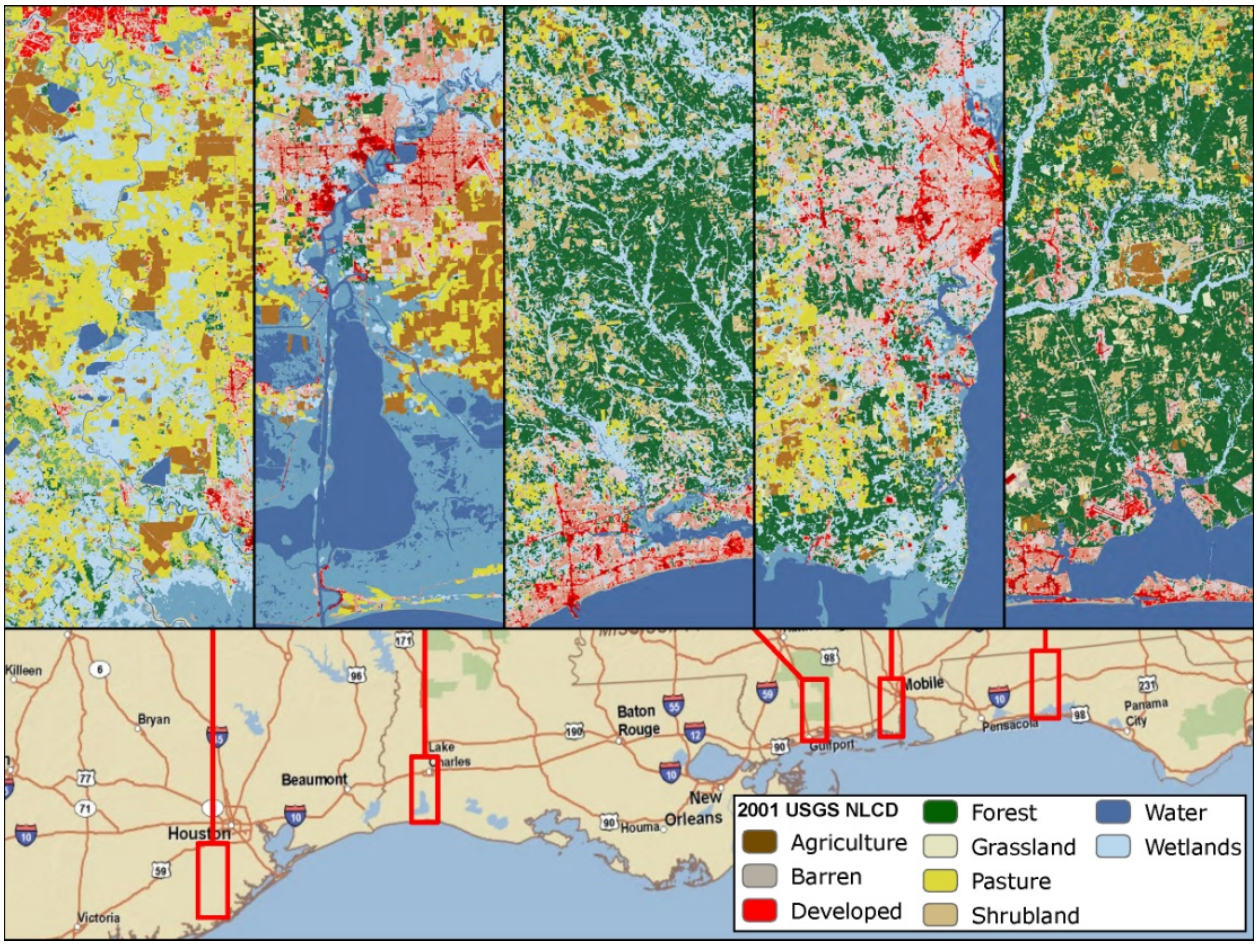

Figure 1. Land use reflects cumulative social choices.

Determining stakeholder willingness for implementing management practices can also help prioritize and target areas for nutrient reduction as well as water quality protection and restoration. As stated above, greater detail can be added to this map on specific categories of land use or land cover that are important to individuals and communities within the watershed.

Documenting the current status and historical water quality trends, in many cases, benefits from the local and historical knowledge of stakeholders. This is particularly true for designated-use relevant biological endpoints such as fisheries, wetland extent, wildlife habitat, or bird and mammal species. Local knowledge is also useful in documenting historical changes in land use and land management practices that might have contributed to legacy issues that need to be addressed.

Agricultural, industrial, and land management stakeholders can help in the identification of appropriate and applicable management practices through their specific understanding of local conditions that might limit or restrict the effectiveness of some management practices or cause other management practices to be successful. These stakeholders can also provide insight into the costs and benefits associated with management practices (e.g., constructed wetlands that treat runoff can also be used as duck hunting leases in the fall). Stakeholders can also help identify groups or individuals whose interest is in impeding or stopping the process of implementing nutrient reduction strategies and help navigate around these obstacles or barriers.

Designing monitoring networks and selecting appropriate metrics can benefit from stakeholder input in several ways. Volunteer monitoring for nutrients can increase awareness of water quality needs and contribute to an understanding of local watersheds. Stakeholders can also help identify indicators and metrics that help in decision-making. A survey of over 25 state and federal water division managers indicated that, while indices were useful in communicating with the public, they preferred to have the individual metrics, so they could mix and match as needed as different issues arose such as 401 certifications, 303(d) listings, 305(b) assessments, 404 dredging permits, or NPDES permit compliance. Stakeholders can also help identify possible uses of information relevant to assessing nutrient reductions.

Economic incentives and funding sources can engage stakeholders, because, as one workshop participant stated, “It’s an opportunity to address our issues, our way, with your money,” which makes it attractive to stakeholders. For some private sector industries, recognition and positive public acknowledgement might be the incentive. For nonprofit, civil society organizations the incentive may be the opportunity to further the cause of environmental conservation. Regardless of the motive, incentives—economic or other—are important mechanisms for engaging stakeholders.

Communication with the public can be significantly enhanced through stakeholder involvement because each of them has their own sphere of influence and can serve as liaisons in communicating within this sphere. Environmental organizations can help communicate with their constituents by packaging the information in a format that will be readily understood by their constituents, and communicating through media and vehicles that are already established.

They can serve as champions throughout the process of developing and implementing nutrient reduction strategies.

Adaptive management requires that stakeholder involvement be a long-term process. It also requires redundancy to ensure that as individual stakeholders move or leave that their perspective is still represented. Stakeholders can also help implement needed modifications or adaptations to existing management practices over time by encouraging changes within their respective spheres of influence.

STRATEGIC QUESTIONS

A set of questions is proposed to help guide the information needs associated with each strategic element. These questions are associated with each of the strategic element descriptions in the template. Using questions helps frame and better define the strategic elements for stakeholders. Other benefits of questions were identified by the workshop participants. In some instances, the questions themselves help identify critical stakeholders who need to be involved in the process of developing and implementing nutrient reduction strategies. The questions can also help identify what information is known and where there are critical needs for research or additional data collection. These same questions, or very similar questions, can also be used during a review of existing regulations, policies, management programs and planning areas to identify information useful for developing nutrient reduction strategies or leveraging the resources within these programs to help in reducing nutrients in coastal watersheds.

CRITICAL NEEDS

Throughout the workshop, there were discussions of critical collective needs among GOMA states. While these do not contribute to developing and implementing nutrient reduction strategies, satisfying these needs could significantly improve the comparability and compatibility of nutrient reduction strategies among states. In addition, several of the federal partners indicated that state needs are very useful in helping justify both on-going research and new research initiatives. Some of these critical needs included:

1. Combined SPARROW model for comparable estimates of nutrient loading from watersheds both east and west of the Mississippi River.
2. Consistent approaches for estimating flow from ungaged watersheds for nutrient loading estimates.
3. Consistent land use coverage and categorization among the GOMA states, with comparable detail and coverage.
4. Common repository for management practices applicable for coastal watersheds that includes information on the effectiveness of the practice in reducing nutrient loading, and the associated costs and benefits.
5. Consistent approaches for estimating both market and non-market benefits of nutrient reduction to coastal ecosystems.

6. Set of case studies illustrating successes in reducing nutrients in coastal watersheds at multiple scales from the implementation of a decentralized wastewater treatment system in a coastal subdivision to nutrient reductions from clustered management practices in a coastal watershed.
7. Common web site or bulletin board for sharing lessons learned among GOMA states.
8. Collaborative workshop among managers in the Chesapeake Bay and Great Lakes Program with GOMA managers to learn from their 20+ years of involvement with large, multi-state efforts to restore major waterbodies.

This list is not meant to be exhaustive. It does indicate that a companion information sharing and research effort would provide useful benefits for all GOMA states.

Coastal Nutrient Reduction Template Development Workshop
5 Rivers Conference Center
Spanish Fort, AL
28-29 September 2009
Workshop Agenda

Time	Topic	Individual
Monday 28 Sept. 1:00 pm	Welcome, Introductions, Workshop Purposes: 1. Provide the rationale for a common nutrient reduction template for use by GOMA states in coastal watersheds. 2. Define a coastal watershed. 3. Establish guiding principles and building blocks for nutrient reduction strategies. 4. Review major coastal issues and ongoing state efforts 5. Review and revise the strawperson strategic elements as the template for GOMA state nutrient reduction strategies. 6. Formulate a set of guiding questions for each strategic element. 7. Identify critical stakeholders who need to participate.	K. Thornton, FTN Facilitator
1:20	Rationale for Common Nutrient Reduction Template • Presentation and Workshop Charge • Questions and Discussion	K. Thornton
1:50	Defining A Coastal Watershed • Criteria - Hydrologic unit? - Land use? - Topography? - Proximity or distance from coast? • Discussion	ALL
2:35	Guiding Principles and Building Blocks • Review Strawperson List - Additional Suggestions - Refinements • Discussion and Consensus	ALL
3:20	**BREAK**	ALL
3:40	Coastal Management Practices & Current State Coastal Nutrient Reduction Efforts • Nutrient Sources & Issues across Northern GOM • Applicable Management Practices • Existing Implementation, by State - AL, FL, LA, MS, TX	ALL
4:45	Afternoon Summary, Action Items, Review Tuesday's Agenda, Homework	K. Thornton
5:15	**ADJOURN**	

Time	Topic	Individual
Tuesday 29 Sept. 8:15 am	Review Tuesday's Agenda Things That Went Bump In the Night	K. Thornton
8:30	Review, Revise Strategic Elements • Break-out Groups • Appropriate Elements? • Consolidated List? • Expanded List? • Discussion	ALL
10:00	**BREAK**	
10:15	Review, Revise Strategic Elements (Con't)	ALL
11:00	Break-Out Group Reports • Common Elements • Differences • Consensus	ALL
11:45	**LUNCH**	
12:15	Strategic Elements – Guiding Questions • Break-out Groups • Review Strawperson Questions • Refine Questions	ALL
1:45	Break-Out Group Reports • Common Questions • Consolidated List	ALL
2:15 pm	Engaging Stakeholders • Break-out Groups • Partnerships? • Collaboration? • Communication? - Creating Awareness - Outreach - Education	ALL
3:15	Break-Out Group Reports • Commonalities • Differences • Consensus	ALL
3:45	Workshop Summary and Next Steps	K. Thornton
3:55	Final Comments	ALL
4:00	**ADJOURN**	

Appendix B:

Summary of Coastal Issues in GOMA States

ALABAMA

Coastal issues Alabama is dealing with include:

- Growth of development along the coast
- Stormwater and stormwater permitting
- Documenting water quality improvement from stormwater management

The following activities are occurring in coastal areas:

- The coastal water quality monitoring program is being upgraded to have a more holistic focus and provide information to track water quality status and trends,
- Wastewater system upgrades – converting from septic systems to decentralized treatment, e.g., west Mobile County
- Formation of the first county Stormwater Authority in Baldwin County

FLORIDA

Coastal issues Florida is dealing with include:

- Developing ecological endpoints for nutrient total maximum daily loads (TMDLs)
- Developing nutrient criteria for estuaries
- Stormwater regulation/permitting
- Stormwater management, including documenting water quality improvement that results
- Impacts of changing nitrogen-phosphorus ratios in coastal waters and reduced sediment loads to coastal waters due to nonpoint source management
- Atmospheric deposition of nutrients

The following activities are occurring in coastal areas:

- In Tampa Bay, a nutrient load cap has been put in place – no increase in nutrient load to the Bay will be allowed with increased development. National Pollutant Discharge Elimination System (NPDES) permit holders have agreed to the need to maintain the nitrogen load to the Bay at 2002-2007 levels, and a formal agreement is in the works.
- A state law requiring training and certification of commercial and government/public works fertilizer appliers.
- Local ordinances banning all fertilizer application during specific months.
- Formation of Nitrogen Management Consortium to foster partnerships outside of the regulatory framework
- Development of a draft rule for water quality trading credits in the St. Johns River watershed, led by permittees.

LOUISIANA

Coastal issues Louisiana is dealing with include:

- A consent decree requiring development of TMDLs through 2011, including numerous dissolved oxygen (DO) TMDLs where low DO conditions are related to nutrient levels
- Urban stormwater
- Post-Hurricane Katrina development in new areas, e.g., north of Lake Pontchartrain
- Loss of coastal land mass/wetlands
- Nutrient inputs from fishing camps
- Developing nutrient criteria for estuaries
- Gulf hypoxia

The following activities are occurring in Louisiana coastal areas:

- Smart growth training and application for stormwater management
- Mississippi River diversions and wastewater discharges to coastal wetlands for wetland restoration and land-building are being recognized as having the potential to reduce nutrient loads to coastal waters and offering opportunities for credit for carbon sequestration and nutrient water quality trading
- Agricultural nutrient management programs on sugar cane lands
- Voluntary Environmental Leadership Program for point sources dischargers, which enable dischargers to move beyond compliance and receive good press through recognition of voluntary pollution prevention activities

MISSISSIPPI

Coastal issues Mississippi is dealing with include:

- Developing nutrient criteria for estuaries
- Nutrient TMDLs
- Stormwater
- Storm sewer overflows in small, non-permitted systems
- Abandoned sewer lines in areas impacted by Hurricane Katrina carrying stormwater to wastewater systems, contributing to sewer overflows
- Coastal water quality assessment

The following activities are occurring in Mississippi coastal areas:

- Infrastructure rebuilding and improvement post-Hurricane Katrina, e.g., switching from septic systems to decentralized wastewater
- Bay St. Louis nutrient model, mixing zone study, and tributary nonpoint source strategy

- Smart growth application in rebuilding occurring in areas impacted by Hurricane Katrina
- Green infrastructure leadership training
- Partnerships for coastal restoration including the Mississippi Department of Environmental Quality and Mississippi Department of Marine Resources
- Environmental leadership program for point sources
- Use of wetlands to treat stormwater and domestic wastewater
- Developing Delta nutrient reduction strategy

TEXAS

Coastal issues Texas is dealing with include:

- Developing nutrient criteria for estuaries
- Stormwater
- TMDLs in Houston
- Bacteria source tracking
- Impacts of upstream reservoir operations on estuaries (e.g., loss of sediment, flow)

The following activities are occurring in Texas related to coastal areas:

- Using wetlands to treat domestic wastewater and reduce nutrient inputs to reservoirs, providing value-added benefits
- US Geological Survey flow balance studies
- Aquaculture projects using wetland-treated water
- Partnership with Mexico to encourage wetland treatment of sewage