

Maryland Wetland Monitoring Strategy

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INTRODUCTION

This report is the final deliverable of a multi-year effort to develop a comprehensive strategy for monitoring wetlands in Maryland. The report contains background information on goals and objectives; discussions and decisions made to date; pilot project summaries that may guide strategy development; and other related monitoring efforts. While wetland monitoring and assessment is undertaken in Maryland to meet various objectives, the impetus for this project is the requirement to monitor wetlands to meet Clean Water Act requirements.

The Clean Water Act was authorized in 1972 with the goal of protecting the chemical, physical, and biological integrity of the Nation's waters. Among the provisions and programs required under the Act, Section 305(b) requires that the States conduct biannual monitoring to provide essential data for water quality protection. Maryland has extensive programs for conducting chemical and biological monitoring in surface and ground waters to meet these requirements. However, within Maryland's monitoring programs, there is not a complementary effort underway for wetlands, despite their dual status as "waters of the United States" and "waters of the State." This Strategy describes how Maryland proposes to monitor and assessment wetlands for a variety of objectives, including meeting Clean Water Act requirements. Monitoring and assessment efforts conducted outside of MDE and Clean Water Act programs are noted.

STATUS

MDE was awarded a U.S. Environmental Protection Agency State Wetland Program Development Grant to develop the wetland monitoring strategy in 2004, with a start date in 2005. The first years of the grant were devoted to analysis of existing methods, investigations into program improvements, and internal policy discussions, as well as MDE participation in various technical groups. A work group comprised of State agency representatives met in 2006 to reach general consensus on a draft classification system, as well as to monitor and assess wetland condition and function. MDE formed a group of diverse stakeholders of federal, State, and local agencies, development, conservation and research entities, to provide comment and assistance in preparing the final strategy. The final strategy was completed in September 2010.

The strategy includes recommendations and tasks for two options: those that can be done with existing resources, and those that are recommended, but will need additional resources. Meetings of the work group began in September 2009 and were held monthly through their conclusion in February 2010. Meeting minutes and the work group participants are in Appendix A.

STRATEGY DEVELOPMENT

Maryland's wetland management activities are diverse and spread among numerous State agencies, and in different programs within those agencies. Due to the extent of information and diverse management efforts, implementation of a detailed, multi-agency strategy will likely be a complicated process. The number of potential information sources, their suitability, limitations,

format, and location is extensive. Various references and studies of Maryland's wetlands have been recorded over the decades by various agencies and other researchers. More recently, geographic information systems (GIS) have been used to identify wetlands and manipulate electronic data layers to aid in the development of management recommendations. A comprehensive wetland assessment strategy requires that all of these entities participate in wetland monitoring and assessment and provide information in a format usable to stakeholders. It is, therefore, essential that the strategy contain a detailed work plan based on investigation of existing information and future study to avoid duplication, eliminate unnecessary tasks, and meet the needs of various partners. The need exists to also minimize the additional burden placed on participating partners in the strategy.

Information is currently found in various electronic and hard copy sources among agencies. Key agencies and their activities are:

- 1) Maryland Department Of the Environment (MDE - State lead for Clean Water Act requirements): 1) Prepares 303(d) list of impaired waters and prepares and adopts Total Maximum Daily Loads (TMDLs) for pollutants; 2) Prepares and adopts water quality standards and use designations. Requires and approves watershed plans in certain local jurisdictions and conducts other watershed planning efforts; and 3) Implements regulatory programs for air, waste, water, etc. (water programs include wetlands and waterways, sediment and stormwater, point and nonpoint source discharges, surface and ground water supply, and water quality infrastructure improvements and restoration). MDE information that will be evaluated as part of the assessment strategy includes:
 - a) Wetland delineation, impact, mitigation, restoration, preservation and assessment information;
 - b) Stream stabilization and monitoring information;
 - c) Watershed or similar plan assessments;
 - d) Flood study information; and
 - e) Water quality monitoring results.

- 2) Maryland Department of Natural Resources (DNR - State lead for natural resource assessment, planning and management (including habitat, fisheries, wildlife, and biodiversity), land conservation and protection, and management of State lands): 1) Implements and oversees land management, protection and restoration programs such as the Critical Areas Program, Forest Conservation Act, Program Open Space, Rural Legacy, Tributary Strategies, and State forests and parks; 2) Prepares 305(b) biannual report of condition of State waters; 3) Conducts MBSS, natural heritage and biodiversity assessments, stream corridor assessments, surface and ground water quality monitoring, watershed and landscape assessment and planning; and 4) wetland and riparian restoration. DNR information that will be evaluated as part of the monitoring strategy includes:
 - a) Wetland restoration, preservation, assessment information;
 - b) Stream corridor surveys, water quality and aquatic species synoptic surveys, and MBSS results;

- c) Landscape and watershed assessments (such as Green Infrastructure Assessment, restoration targeting);
 - d) Shoreline surveys; and
 - e) Biodiversity, wildlife, fisheries and vegetative community sampling.
- 3) Maryland State Highway Administration (SHA - State lead for highway transportation projects): Conducts numerous wetland and waterways assessments, environmental impact analyses, and mitigation in association with highway projects. SHA information that will be evaluated as part of the monitoring strategy includes:
- a) Wetland classification, functional assessment, and mitigation information;
 - b) Fish, wildlife, and other habitat assessments; and
 - c) Stream classification and assessments.

Coordination took place with other State agencies, such as the Department of Agriculture (MDA). MDA supports numerous conservation, wetland, and riparian restoration projects. A list of stakeholders participating in the strategy development is shown in each copy of meeting minutes in Appendix A.

The comprehensive strategy integrates wetland monitoring and assessment into other aspects of wetland management. Uses of monitoring and assessment information and its implications for other programs include:

- 1) Regulatory program - Wetland permit reviewers will have a better understanding of condition and function of wetlands proposed for impacts by regulated activities. This will allow the review and best management practices to be more tailored to the particular wetland type. Mitigation projects will also be designed, constructed, and monitored more effectively.
- 2) Wetland restoration - As will be the case for mitigation projects, voluntary wetland restoration projects will also be designed, constructed, and monitored more effectively. Restoration sites can be better prioritized to meet needs of the water quality, habitat, recharge, and flood attenuation needs of a particular watershed. The context of potential restoration sites within the larger landscape or watershed can be determined and help with site location and design.
- 3) Wetland preservation – The highest quality wetlands of various types can be made priorities for protection, again considering these areas within the larger landscape or watershed context. Adjacent land uses which are found to cause significant degradation of wetland condition can be addressed with regulation or public education.
- 4) Watershed planning – The information on wetland condition and function can be incorporated into watershed management or restoration plans, along with stream corridor and stream bioassessment results. The predominant stressors of wetland condition can be identified and addressed through public education.
- 5) The ability to develop watershed wetland profiles can be improved through the development of additional skills, (in particular HGM classification and spatially random sampling procedures for wetland selection,).

- 6) Water quality monitoring and restoration – The wetland information will be incorporated, as appropriate, into Clean Water Act 305(b) and 303(d) reporting. Considerable work remains to be done in terms of developing designated uses for wetlands of various classes before wetlands can be assessed as meeting or not meeting their specific designates uses. This information will, as appropriate, become part of TMDL and implementation plan development to remove waters from the impaired waters list.

The project sought consensus from a variety of stakeholders in wetland management. Consensus was sought through discussions and exchanges of written materials between stakeholders. The first meetings were held with representatives from State agencies only. Meetings of State agency representatives were held on August 29, 2006; September 19, 2006; and October 19, 2006.

Numerous ongoing monitoring activities were identified during the initial meetings. . MDE applied a cursory approach using best professional judgment about habitat, water quality, etc. in regulatory review. The State Highway Administration (SHA) conducted more formal assessments. Mitigation sites are monitored for vegetation, soils, hydrology but little work was done at this time to measure function. Voluntary restoration projects had some monitoring to determine if projects were built to design. Assessments were also done for potential State land acquisitions. Monitoring to meet Clean Water Act requirements was the major new impetus and is the result of lawsuit settlements in Pennsylvania and Delaware that confirmed that like other waters, wetlands must be monitored. The Clean Water Act requirement is to "restore and maintain chemical, physical, and biological integrity of the Nation's waters."

An early step was to determine a system to classify wetlands for monitoring. After several meetings, MDE and DNR developed a draft classification system in 2007 to present to the Work Group. The classification is a modified version of the HGM classification, which can also be translated into the classification system used for wildlife habitats. A unique addition is the designation of a separate class for wetlands that are constructed, whether for mitigation, restoration, or water quality improvement. The class is under consideration to recognize that newly established wetlands are often built for a specific purpose, are built in a disturbed area, and are in an early successional stage. Comparison of these wetlands with a more mature natural system, at least for an initial period, may incorrectly indicate that these wetlands are in poor condition or not performing desired functions. The creation of a separate class prevents this problem. The draft classification was completed in 2007.

The system is shown in the table below:

Table 1. New Classification and Existing Classifications

LEVEL 1				LEVEL 2		
MD Wetland Class	HGM Class	NWI class	Brief Description	Hydrology 1) source, 2) hydrodynamics 3) hydroperiod	Key Wildlife Habitat	Physiographic Province of Occurrence ²
Tidal Freshwater	Fringe	PFO PSS PEM	0 – 0.5 ppt Salinity and head of tide	1) Overbank flow from channel 2) Bidirectional, horizontal, vertical 3) Diurnal	Tidal Shrub Wetlands Tidal Marshes	UCP, LCP
Tidal Estuarine	Fringe	E2SS E2EM E2FO	> 0.5 ppt Salinity	1) Overbank flow from channel 2) Bidirectional, horizontal, vertical 3) Diurnal	Floodplain Forest	UCP, LCP
Non-tidal Riparian Headwater Complex	Riverine, slopes, depression	PFO, PSS, PEM	Riparian zone of waterway, floodplain, and transitional upland fringe <or = 3 rd order mosaic of low/high gradient streams, depressions, toe-slopes	1) Overbank, groundwater, surface runoff 2) Bidirectional, horizontal, vertical 3) Variable	Floodplain Forest Nontidal Shrub Wetlands Nontidal Emergent Wetlands Forested Seepage Wetlands Bog and Fen Wetland Complexes Vernal Pools	AP, RV, PD, UCP, LCP
Non-tidal Riparian Mainstem Complex	Riverine	PFO, PSS, PEM	Riparian zone of waterway, floodplain, and transitional upland fringe > 3 rd order mosaic of low/high gradient streams, depressions, toe-slopes	1) Overbank, groundwater, surface runoff 2) Bidirectional, horizontal, vertical 3) Variable	Floodplain Forest Nontidal Shrub Wetlands Nontidal Emergent Wetlands	AP, RV, PD, UCP, LCP
Seasonal Flat (mineral soil) • Connected • Isolated	Mineral Flat	PFO, PSS, PEM	Broad, flat areas with poor drainage	1) Precipitation, groundwater, overbank 2) Vertical 3) Temporarily to semi-permanently flooded	Vernal Pools	AP, RV, PD, UCP, LCP
Peatland • Connected • Isolated	Organic Flats + Depressions	PFO, PSS, PEM	Broad, flat areas or depressions with sustained saturation and deep peat	1) Precipitation, groundwater 2) Vertical 3) Saturated, semi-permanently flooded	Bogs and Fens	AP, RV, PD, UCP
Isolated Depressional	Depression	PFO, PSS, PEM	Topographic low area lacking hydrologic connection to riparian tidal waters	1) Precipitation, Groundwater, surface run-off 2) Vertical 3) Temporarily, seasonally, to semipermanently flooded	Upland Depressional Swamps Vernal Pools	AP, PD, UCP, LCP
Isolated Seepage Slope	Slope	PFO, PSS, PEM	Discharge area lacking observable surface connection to riparian or tidal waters	1) Groundwater 2) Unidirectional, horizontal 3) Saturated most or all of the year	Upland Depressional Swamps Carolina Bays Vernal Pools Nontidal Shrub Wetlands Nontidal Emergent Wetlands	AP, RV, PD, UCP, LCP
Constructed or Incidental	Any class	PFO, PSS, PEM	May become any of above classes after wetland matures	Any of above sources	Forested Seepage Wetlands Bog and Fen Wetland Complexes, stormwater, mitigation, mining, highway and other incidentals, lake and pond fringes, voluntary	AP, RV, PD, UCP, LCP

¹from Cowardin (1979) ²AP=Allegheny Plateau; RV=Ridge and Valley; PD=Piedmont; UCP=Upper Coastal Plain; LCP=Lower Coastal Plain

In 2008, the work plan was revised to delete a field pilot study and expand deliverables from the strategy to include draft water quality standards, potential wetland reference sites, a template for a Level 3 assessment, and conceptual data storage system. MDE entered into an interagency agreement with Virginia Polytechnic Institute and State University (Virginia Tech) to prepare a background report on Maryland's wetlands and a literature review of assessment methods for background information. The background information was completed in September 2009 and is included in Appendix B. The literature review (Appendix C) was completed in March 2010.

A request for moderator services for work group meetings and preparation of background materials was released in December 2008. A contract was finalized with the selected vendor, the Association of State Wetland Managers (ASWM). Four briefing papers were completed on the following topics: 1) how water quality standards for wetlands differ from those of traditional waters; 2) establishing water quality standards for wetlands; 3) implications and management options for wetlands that fail to meet designated use criteria; and 4) wetlands and TMDLs. Final documents were completed in 2010 and are included in Appendix D.

MDE held its first meeting with an advisory work group on September 23, 2009. Representatives from federal, State, and local governments, the homebuilders association, private conservation organizations, consultants, and research organizations were invited and attended. Dr. Jon Kusler of the Association of State Wetland Managers served as moderator. The meeting focused on establishing a recommended baseline and inventory for wetlands in Maryland. A consensus was reached on MDE's recommendation to use both National Wetland Inventory and Maryland-DOQQ wetland maps, and to solicit other local information sources. Any acreage baseline and status and trend information will be clearly described, with rationale for the estimate and appropriate caveats. The proposed wetland classification system was also presented.

MDE held subsequent monthly meetings with the advisory work group on October 19, 2009; November 16, 2009; December 15, 2009; January 12, 2010, and February 22, 2010. The meetings focused on different aspects of wetland management, as listed in the overall strategy objectives. Meeting topics were: assessments for compensatory mitigation, restoration, and regulatory review; large scale and watershed planning; National Wetland Condition Assessment; wetland preservation and tidal wetland sustainability; monitoring and assessment for Clean Water Act requirements. The latter topic included discussions of wetland water quality standards, TMDLs, and how to structure an assessment for Clean Water Act integrated reporting. Meetings concluded in February 2010.

Other Actions Related to Strategy Development

Maryland has been a member of the Mid-Atlantic Wetland Work Group (MAWWG), an organization of federal and State agencies and academic institutions that exchanges information on various aspects of wetland monitoring. MAWWG has held semi-annual meetings since 2002. MDE regularly attended the meetings to gather and exchange information for managing its strategy development.

As “waters of the United States,” wetlands must be managed to protect, restore, and maintain the chemical, physical, and biological integrity of the Nation’s waters. States must now implement a monitoring program to report on how their waters meet the chemical, physical, and biological integrity. This is accomplished by the formal adoption of State water quality standards and structuring the monitoring program to measure water parameters against the established standards. Water quality standards consist of three components: include use designations, narrative or numeric criteria, and an anti-degradation policy. States now report bi-annually on waters, and list those that fail to meet designated uses (impaired waters). Impaired waters are placed on the Clean Water Act Section 303(d) list, and may require development of a total maximum daily load (TMDL) for the impairing pollutant. TMDLS, in turn are used for implementation to bring the water body into compliance with water quality standards.

Many of the early meetings of MAWWG and pilot efforts to date have focused on the monitoring of wetlands in terms of conditions, as a deviation from a least disturbed state. This monitoring does not necessarily meet all aspects of Clean Water Act requirements, which requires monitoring to determine if certain designated uses, as defined by a State, have been met. For traditional waters, uses have such designation in Maryland as natural trout waters, recreation trout waters, and shellfish waters. Minimum standards at the federal level are for waters that “fishable” and “swimmable,” which would not often be reasonable criteria for a wetland.

The first detailed discussions for any type of designated use during MAWWG meetings were in April 2005. Presentations from representatives from Pennsylvania State University, Maine, and Ohio presented their approaches to date for tiered aquatic life uses (TALU) for wetlands. It is anticipated that Maryland will have some sort of designated use for habitat or aquatic life. Some protocols developed to date or that are in progress are of plants and macroinvertebrates. Within a TALU, the ranking system has levels that denote living communities that change in response to certain stressors. At a minimally disturbed level, the living resource would support balanced indigenous species populations. As disturbance increases, species that are known to be more tolerant of pollution would begin to predominate and species diversity would decline.

MDE collected information from 11 other States that have, at a minimum, formally adopted designated uses for wetlands. Some States also have narrative and numeric criteria and antidegradation policies. State language under review is from Massachusetts, Pennsylvania, North Carolina, Minnesota, Ohio, Wisconsin, Iowa, Nebraska, Wyoming, California, and Washington. Maryland participated in extensive discussions with EPA and other States at the annual State/Tribal/Federal Coordination Workshop on March 1-2, 2006 in Washington, D.C. The workshop was sponsored by EPA and the USDA Natural Resources Conservation Service. Useful contacts were made that aided Maryland in producing its strategy. MDE has shared this information with DNR and will provide the information in the future to the interagency workgroup to allow consideration of this information and information from other states not currently included.

MDE, DNR, and EPA and other stakeholders met on May 21, 2007 in Ocean City, Maryland for a Wetland Monitoring and Assessment Management meeting. The meeting was part of a larger water quality monitoring meeting, and brought together wetland and other water

monitoring personnel to discuss issues involved with monitoring wetlands to meet Clean Water Act requirements, particularly designated uses, reporting, and TMDLS.

MDE also provided comments on EPA's 2007 guidance on wetlands and TMDLS. Concerns and questions were raised about some language suggesting that designated uses, 303(d) listings, and TMDLS may not have to be prepared for wetlands. This is not MDE's understanding. EPA and Maryland representatives will meet, probably in 2008, to resolve concerns. Maryland is supportive of an alternative approach for addressing impaired wetlands, such as through watershed-based restoration, preservation, and enhancements, which may be acceptable for meeting Clean Water Act requirements.

OBJECTIVES

The purpose of this comprehensive strategy is to monitor and assess the condition and function of wetlands in Maryland and to initiate its implementation. Prior to this strategy, Maryland did not have an approach in place that would guide development of a statewide wetland monitoring and assessment program. Maryland has made some strides in the development of tools for the assessment of wetlands and landscapes. These tools may have a place in the development of wetland monitoring. There are multiple objectives for Maryland's wetland monitoring and assessment program, which will be related to other regulatory and non-regulatory wetland management programs:

- 1) Meet 305(b) reporting requirements;
- 2) Improve existing wetland and waterway regulatory programs;
- 3) Provide additional information for targeting wetland/waterway restoration and protection efforts;
- 4) Comply with TMDL requirements, if applicable;
- 5) Develop use designations and water quality standards for wetlands;
- 6) Assist in evaluating the effectiveness of compensatory mitigation and voluntary restoration projects;
- 7) Improve our ability to comprehensively assess landscape and watershed function;
- 8) Develop the capability to study and assess the status of wetland condition over time; and
- 9) Make wetland condition and functional value information available for use in federal, State, local and citizen group-driven natural resource conservation and restoration efforts (examples include Tributary Strategies, TMDL implementation plans, Green Infrastructure Assessment, Strategic Forest Lands Assessment, etc.).

MONITORING DESIGN

Monitoring will be designed to assess both wetland condition and wetland function. Data is expected to be transferable to other regional wetland assessments. Wetlands will be classified according to Table 1, which will use a hydrogeomorphic based approach and corresponding key wildlife habitat classification according to the Maryland Wildlife Diversity Conservation Plan (2005).

Some tasks listed here are voluntary, and may be conducted by entities other than MDE, and are not subject to MDE's authority. The tasks are included as part of the comprehensive strategy, but may not be part of formal overall water monitoring strategy due to the lack of a required mandate.

Regulatory Monitoring -- Recommended Actions Using Existing Resources

- 1) The design is completed to date for monitoring nontidal wetlands created, restored, or enhanced for compensatory mitigation. MDE will visit and score all compensatory nontidal wetland sites, according to methods described in the next section. The emphasis will be on sites within their first five years of construction, when the permits and regulatory authority to require necessary remediation is in effect. MDE's guidance to applicants for monitoring mitigation sites will be updated. The method is included in Appendix E.
- 2) MDE will begin an evaluation of tidal wetland compensatory wetland mitigation sites.
- 3) Assessment of nontidal wetland sites for regulatory purposes will continue with the checklist shown in Appendix G. Improved guidance and rationale for indicators will be developed. A combination of indicators may be used from different methods that were evaluated through the literature review. Assessments will be completed for all sites visited in the field. MDE anticipates that, in the future, applicants for regulated activities will be required to complete a formal assessment.
- 4) MDE will include locally available vernal pool maps in screening for proposed regulated activities.
- 5) MDE will create new map layer of polygons of successful wetland mitigation sites.

Regulatory Monitoring -- Recommended Actions Using Requiring Additional Resources

- 1) Include updated wetland boundary determinations and assessments conducted during regulatory review into spatial database to update guidance maps and wetland condition/functional assessment baseline.

Voluntary Restoration Monitoring -- Recommended Actions Using Existing Resources

- 1) Continue monitoring of restored sites to determine if projects were built according to design and project objectives are met.
- 2) Continue monitoring and spot checks of restored sites to ensure sites are being maintained per funding program requirements through agreement duration (i.e. program compliance).

Voluntary Restoration Monitoring -- Recommended Actions Requiring Additional Resources

- 1) The Natural Resources Conservation Service (NRCS) would seek funding to collaboratively investigate use of synthetic aperture radar (SAR) to remotely evaluate wetland hydrology pre- and post-restoration.
- 2) The U.S. Fish and Wildlife Service (USFWS) would conduct more monitoring of pre-and post activity burns for marsh management.
- 3) Conduct long-term monitoring sufficient to improve models of nutrient uptake and transformation in restored and natural wetlands for Chesapeake Bay restoration.
- 4) NRCS would seek funding and collaboration to measure success of Phragmites eradication programs.
- 5) USFWS would monitor changes in species diversity as a result of adding organic amendments to restored or constructed wetlands, if amendments are intended to provide substrate for aquatic invertebrates.
- 6) Advocate use of IRIS tubes should be advocated to provide a qualitative or quantitative (depending on how they installed and ultimately interpreted) assessment of the soil redox potential.
- 7) Monitor wetlands that have had nutria removed: vegetative response and elevation of the marsh surface (is the damage to a particular marsh from nutria herbivory permanent?)
- 8) Monitor to obtain more information about current conditions, particularly hydrology.
- 9) Monitor to evaluate the scope and effect of methods used to restore hydrology in wetlands.
- 10) Develop a model to better determine the effects of ditching on wetland hydrology and services.

Large-scale Assessments -- Recommended Actions Using Existing Resources

- 1) Provide training to local governments and other stakeholders in use of wetland-related data layers, with clear explanations of how the layers were derived, what associated assumptions are, and what the data represent.
- 2) In order to promote restoration and watershed planning, planners should make the link between wetland values and Bay restoration.

- 3) Link wetland data and management with other local government goals and functions. Local governments should strive for consistency with State requirements and recommendations.
- 4) MDE shall complete review of the VIMS-GIS layer for wetland stressors and prepare recommendations on its use.
- 5) MDE will identify area-wide systems of potential reference sites.
- 6) Collect much observational data and limit reliance on models.
- 7) Design monitoring efforts to fit into surface water quality reporting and regulation, considering how wetlands relate to stream function, beneficial uses, and water quality standards, including policies related to Tier II waters and their adjacent wetlands.

Large-Scale Assessments -- Recommended Actions Requiring Additional Resources

- 1) Design and implement monitoring approaches to determine the effect of increasing the water storage function in drained wetlands on downstream water quality and stream baseflow. LiDAR and other GIS-based hydrology tools should be further explored to determine the effects and help identify restoration opportunities.
- 2) Combine large scale assessments using LiDAR and SAR with intensive field sampling, to improve identification of restoration sites and determine scope and effect of hydrological alterations. The USDA pilot in the Choptank River should be used as a model.
- 3) Local government planners should aid in educating the public, wetland monitoring, developing protection practices, and helping to match interested landowners with funding agencies for restoration, preservation, or mitigation. Clear tools should be developed that lay people and local planners can use and understand.

Monitoring and Assessment for Wetland Preservation -- Recommended Actions Using Existing Resources

- 1) Assess wetlands for occurrence of targeted species (endangered, threatened, or in need of conservation, or species of greatest conservation need) for acquisition of habitat through easement or fee simple purchase.
- 2) Monitor sites under easement to ensure that terms for wetland protection are followed.
- 3) Update and make available data layers useful for identifying and targeting priority areas for preservation.

- 4) MDE will investigate the feasibility of follow up and long term monitoring for preservation of wetlands through the State wetland regulatory program. If feasible, MDE will develop protocols and assessment methods as needed.
- 5) MDE will conduct a pilot effort to assess sustainability of tidal wetlands during regulatory permit reviews.

Monitoring and Assessment for Wetland Preservation -- Recommended Actions Requiring Additional Resources

- 1) Assess tidal wetlands adjacent with contiguous natural vegetation for targeted elimination of Phragmites.
- 2) Expand field assessments of tidal wetlands to identify a) wetlands showing evidence that they are not sustaining themselves through vertical accretion to keep pace with sea level rise and erosion; b) wetlands that are not keeping pace but that appear healthy; c) wetlands that are maintaining rates of accretion likely for long-term sustainability. Protocols will include wetlands in front of structural shoreline stabilization practices.
- 3) Develop rapid protocols, based on intensive tidal wetland assessment, for determining tidal wetland sustainability. Protocols will include wetlands in front of structural shoreline stabilization practices.
- 4) Monitor other wetlands vulnerable to climate change, such as vernal pools.
- 5) DNR shall resume field assessments of properties considered for acquisition under Program Open Space.
- 6) Entities owing land or easements will conduct more intensive monitoring of targeted species to determine success of preservation efforts.

Clean Water Act Requirements -- Recommended Actions Using Existing Resources

- 1) MDE and DNR will investigate integrated monitoring of wetlands with monitoring of other waters, such as the Maryland Biological Stream Survey.
- 2) MDE will prepare a list of potential long-term, fixed station study sites on public land or lands accessible for long-term research. Fixed station sites on public or accessible private land may offer a more cost effective approach, and potentially better long-term trend information for integrated assessments required under the Clean Water Act. The preliminary list of potential sites and site selection protocol are included in Appendix F.
- 3) MDE will solicit information from other researchers on study sites that may be candidates for long-term monitoring.

- 4) MDE will report on status and trends from regulatory gains and losses, voluntary gains, and unregulated losses, if known.
- 5) MDE will develop draft water quality standards with narrative criteria.

Clean Water Act Requirements -- Recommended Actions Requiring Additional Resources

- 1) Conduct long-term monitoring on fixed station sites.
- 2) Implement wetland monitoring program on a rotating basin schedule, and present findings in integrated report.
- 3) Develop rapid method, or use other existing method, that is validated from long-term monitoring.
- 4) Include data from assessment generated through the regulatory process in the integrated, after additional guidance for the assessment are developed and implemented and supporting data management systems are in place. Note: these assessments would be primarily best professional judgment of observed features and indicators until a validated rapid assessment is developed.
- 5) Develop data management system for storing monitoring data and enter data.

CORE AND SUPPLEMENTAL INDICATORS AND METHODS (3 LEVELS)

Level 1. The Strategy recommends use of the following information for baseline wetland inventory and potential wetland location guidance.

Level 1 indicators will include all available mapped wetland layers. Statewide wetland layers are the NWI and DNR (MD-DOQQ) layers. A more recent NWI layer is available for the Coastal Bays and Nanticoke watersheds. There is also partial data available for known vernal pools sites. NWI updates will also be used for baseline assessments and status and trends accounting, and planning purposes. Vegetation class, system, water regimes, and modifiers used in the classification are indicators of potential functions and condition. There are also designated Nontidal Wetlands of Special State Concern, which are most often designated for rare species. Tidal wetlands that were used as reference communities for emergent, shrub, or forested wetlands are shown as point data. Wetland mitigation sites exist as point data but are being created as polygons.

Text is adapted from “Maryland Wetland Conservation Plan,” (2003):

National Wetlands Inventory (NWI) – U.S. Fish & Wildlife Service

The National Wetlands Inventory is a statewide digital coverage of wetlands, typed using the U.S. Fish and Wildlife Service’s (FWS) official wetlands

classification system (Cowardin), by dominant vegetation, hydrology, soils and other properties. NWI digital wetland coverages were produced from 1980 to 1989 using black and white, color infrared, or natural color aerial photograph film transparency at scales ranging from 1:20,000 to 1:132,000. NWI produced 255 maps, at a scale of 1:24,000.

NWI Limitations

Maps produced prior to 1980, during NWI's operational testing of the system, tend to underestimate wetland acreage by omission. Identification of wetlands using photo interpretation has several inherent problems, which limit the accuracy of the final maps.

- 1) Photo interpretation is never as accurate as field delineation.
- 2) Identification is not exact since wetlands are transitional areas between upland and aquatic environments and boundaries are often difficult to delineate.
- 3) The accuracy of identification and mapping of wetlands depends on the landscape setting (local topographic variation) and wetland type. For example, palustrine forested wetlands are most difficult to map using photo interpretation.
- 4) The scale at which certain wetland types are mapped varies. The NWI target mapping unit (tmu) is defined as the size class of the smallest group of wetland that NWI attempts to map consistently.

NWI Strengths

Maps produced after 1980 are more accurate for several reasons:

- 1) Better technical understanding of the concept of the definition of a wetland.
- 2) Changes in mapping technology such as the use of color infrared photography versus black and white photography and larger scale photography.
- 3) Improved procedures such as increased level of quality control and field review. In many areas of the country, NWI maps are the only wetland maps available for planning and management purposes. In Maryland, Department of Natural Resources (DNR) digital ortho-quarter-quad (DOQQ) wetland data is available for most of the Coastal Plain and Piedmont regions. NWI maps are more accurate in identifying wetlands than USGS topographic maps.

NWI will re-map portions of Maryland. When final, these maps should be used in association with other map resources.

Tidal Wetland Maps of Maryland - Maryland Dept. of the Environment

The first major task of the State in implementing the Wetlands Act was to map the upland boundary of the tidal wetlands to establish regulatory jurisdiction for privately owned wetlands. It should be noted that the majority of wetlands evaluated under the Maryland Program are State owned wetlands which include low marsh and open water. The Tidal Wetland Maps of Maryland were completed in 1972 using low-altitude photographs of tidally influenced areas of the coastal and interior bays of Maryland. These maps have not been formally updated since 1972. MDE staff make formal amendments to the maps on a parcel-by-parcel basis for areas that are no longer tidally influenced.

Department of Natural Resources (DNR) Wetland Maps

This map series is created by combining new 1:12000 scale wetland interpretations with color infrared imagery. The hardcopy map sheets are typically produced at a scale of 1:8400 and printed on demand. The classification system is consistent with the Cowardin et al. 1979 classification protocol used by the National Wetlands Inventory.

Uses

These data provide consultants, planners, and resource managers with more precise information on wetland location and type. The data were collected to create a reasonably accurate wetlands baseline for Maryland and assist in wetland/resource management efforts such as those undertaken by wetland regulatory programs, the Chesapeake Bay Program, Coastal Bays Program, and the Coastal Zone Management Program.

Methods

The interpretations are made on 1:40000 scale color infrared diapositive film using conventional manual stereoscope techniques. The interpreters use ancillary data including soil surveys and the existing NWI maps, and they field check photo signatures prior to work in new areas. Delineated wetland boundaries are digitally transferred and registered to the DNR 3.75' DOQQ maps. The digital data files include feature lead lines and labels, in addition to standard attribution, to assist in paper map production. Quality control steps occur throughout the photo interpretation, data management and map production processes. All photo interpretable wetlands are delineated. In general the minimum mapping unit is 1/4 acre depending on the wetland type. Precise delineation of wetlands is very difficult in regions where evergreen forested wetlands predominate and in areas obscured by dense forest cover, therefore, a detailed on-the-ground and historical analysis of these sites may result in significant revisions to the photographic interpretation. In addition, small wetlands can be obscured by a variety of land covers and may not be included in this data set.

Hydric soil layers are also used and recommended for use to identify locations of potential wetlands that are otherwise unmapped. Soil properties are used for restoration planning, and, as supporting data improves, as possible functional indicators and predictors.

From “Maryland Wetland Conservation Plan,” (2003):
Natural Resources Conservation Service (NRCS) Maps
 NRCS maps depicting potential locations of hydric soils are recommended as additional guidance in identifying potential wetland areas, and as an initial screening tool for selecting potential wetland restoration sites.

Additional data layers related to disturbance and land use are recommended for restoration and preservation targeting, and as potential indicators of function and condition. The user must clearly describe the purpose of the assessment, and specify use of the indicators for function as opposed to condition. For example, proximity to developed lands or roads is used in both condition and functional assessment. The proximity in a condition assessment suggests that the wetland may suffer degradation from fragmentation, nonpoint source runoff, and more invasive species as stressors than a relatively undisturbed wetland. The degraded wetlands’ condition score would be lower. In a functional assessment, the same stressors would suggest that the wetland has a higher opportunity for providing a water quality functions. Data layers used in both assessments may include:

- | | |
|---------------------------------------------------------------------|--------------------------------------------|
| Roads | Water/Biological sampling points |
| County Boundaries | Green Infrastructure |
| Watersheds | Streams |
| Land use/Land cover | Nontidal Wetlands of Special State Concern |
| Zoning | Tier II waters |
| Floodplains | Preserved lands |
| Green Infrastructure | Rural legacy lands |
| Threatened or Endangered Species or Species in Need of Conservation | |
| Historical or cultural resources | |
| Discharge or authorized impact sites | |
| Prime farmland | |
| Priority growth areas | |
| Wellhead protection areas | |
| Impaired waters | |
| Water supply watersheds and reservoirs | |

Level 1 GIS Assessment Tools

A Level 1 assessment was completed by the Center for Coastal Resources Management (CCRM) of the Virginia Institute of Marine Sciences (VIMS) in 2008 and described in the document “Building Capacity to Perform Wetland Assessments Final Report.” DNR-mapped polygons were analyzed according to a GIS protocol developed by VIMS for a similar study of Virginia’s wetlands. Habitat and water quality services were assessed in association with certain land use variables within a 30 meter, 200 meter, and 1000 meter buffers. Land use and perceived stressors in the drainage area, based on 10 meter contours, was added to the water quality analysis. Drainage was based on National Hydrographic Dataset, with 10 meter contours.

Recommendations

- 1) The Work Group recommends use both the National Wetlands Inventory and Maryland DOQQ maps as guidance maps for wetland inventory and location. Use of hydric soil maps is also recommended, with the caveat that not all mapped hydric soils will be wetlands.
- 2) The Work Group recommends use of the 1972 tidal wetland maps, with subsequent aerial photography to detect activities in regulated wetlands, unless the legal requirement for using the maps is changed.
- 3) Any estimate of the current acreage of wetlands in Maryland should be made with thorough explanations of the limitations of the data and analysis from past status and trend inventories.
- 4) Recommended data layers should be designated and made available on the MSGIC web site.

Recommended Actions to Be Taken Using Existing Resources

- 1) Contact local GIS managers to identify other data sources that may aid in wetland inventory and conservation.
- 2) MDE will include locally available vernal pool maps in screening for proposed regulated activities.
- 3) MDE will create new map layer of polygons of successful wetland mitigation sites.
- 4) Designate recommended data layers (NWI, DOQQ, soils) with uses and limitations, and make available on the MSGIC web site.

Recommended Actions Requiring Additional Resources

- 1) If the 1972 maps remain in effect, digitization of the tidal wetland line has been found useful by local governments. Expand digitization to the remainder of the State.
- 2) Evaluate and expand use of LiDAR in detecting wetlands.
- 3) Incorporate data from regulatory permit review to update wetland boundary maps.
- 4) Update and re-run model on wetland polygons using updated map layers and digital elevation models.

Level 2

No systematic assessments for tidal wetlands are routinely performed by MDE staff, or generally required of applicants, and is not considered necessary, since tidal wetlands receive equal protection regardless of condition of function.

Most voluntary restoration projects are not subject to MDE requirements for monitoring, but are the responsibility of the sponsoring entity. Voluntary restoration projects are likely to be monitored for simple parameters: project constructed according to approved plans; presence of hydrology; assessment and eradication, if necessary, of invasive species; and survival of planted species. Assessment for targeted species occurs if the restoration were done for certain species. Simple indicators of habitat use, such as visual observation of occurrence and presence of scat, may also be noted.

Rapid field assessments will be used in the regulatory program. The following indicators are used to monitor the effectiveness of compensatory wetland mitigation. An instruction guide and indicators used for the assessment are in Appendix E. The method is a combination of numerical determinations and best professional judgment. The method was developed under a U.S. Environmental Protection Agency Grant and completed in 2007. The following metrics are used:

- 1) Percent cover by native wetland plant species
- 2) Percent cover by non-native plant species
- 3) Diversity (richness and evenness combined) of planned wetland type.
- 4) Plant density of planned wetland type.
- 5) Expected growth of species based on age
- 6) Extent of the planned vegetated area has soil that may be limiting vegetative growth/establishment
- 7) Extent of the planned vegetated area that has wetland hydrology
- 8) Extent of the planned vegetated area has wetland hydrology but is un-vegetated open water (submerged aquatic vegetation is not acceptable vegetation)?
- 9) Extent of the planned vegetated area has wetland hydrology but is too wet (submerged aquatic vegetation is not acceptable vegetation) or too dry to support the planned wetland vegetative type
- 10) Habitat
 - i. Rare, threatened, or endangered wildlife or plants
 - ii. Forest interior dwelling birds
 - iii. Other non-wetland dependent wildlife
 - iv. Reptiles and amphibians
 - v. Other wetland dependent wildlife
 - vi. Fish and other aquatic wildlife
- 11) Furnishing organic material to the aquatic food web
- 12) Water Quality Functions
 - i. Filtering sediments, pollutants and excess nutrients
 - ii. Reducing erosion
- 13) Hydrologic Functions
 - i. Headwater wetland - storing, slowing, or reducing floodwater flow
 - ii. Floodplain wetland - storing, slowing, or reducing floodwater flow
 - iii. Discharging groundwater
 - iv. Recharging groundwater
- 14) Human Values
 - i. Providing recreational opportunities
 - ii. Providing harvestable natural resources
 - iii. Providing educational opportunities

- iv. Providing aesthetic qualities
 - v. Representing a rare ecotype within the watershed
 - vi. Having historic properties
- BONUS. Rare Species Bonus

A documented method for assessing wetlands proposed for impact from regulated activities will be developed using the above list and the New England Highway Methodology supplement described below. Additional guidance on use will be prepared.

The current assessment protocol used by the Maryland State Highway Administration is a modified version of the New England Highway Methodology supplement, shown in Appendix C. Indicators not applicable to Maryland were deleted from the original method. This method does not assign scores to wetlands, but does note presence of indicators of certain functions, and includes rationale for of principal functions of a particular wetland based on best professional judgment.

Functions/metrics are:

- Groundwater recharge/discharge
- Floodflow alteration
- Fish and shellfish habitat
- Sediment/toxicant/pathogen retention
- Nutrient removal/retention/transformation
- Production export
- Sediment/shoreline stabilization
- Wildlife habitat
- Recreation
- Education/Scientific value
- Uniqueness/Heritage
- Visual Quality/Aesthetics
- Endangered species habitat

A review of existing assessment methods (Appendix C) found that most methods relied on simple indicators, usually stressors, to predict wetland condition. These methods would fail to meet MDE's for assessments of wetland function, but may still be adapted or used when the wetland function being assessed is ecological integrity or biodiversity. Condition assessment methods may also be used to identify stressors in terms of their potential for removal, as for a restoration management effort.

The review in Appendix C reveals shortcomings in most existing rapid assessment methods. Issues and considerations in selecting a method are presented, though the review does not recommend a specific rapid assessment approach. Excluding the specific approaches described earlier in this section for mitigation and regulatory assessment, this strategy does not designate a preferred rapid assessment approach. Future tasks, however, would develop some more formal, recommended or required approaches to address specific management needs, particularly for regulatory use and Clean Water Act assessments.

Level 3

The Virginia Polytechnic Institute and State University (Virginia Tech) produced a background report and recommended template (Appendix H) for an intensive, Level 3 assessment for MDE. At MDE's request, the template represents the optimum approach for assessing wetland condition and function. However, since resource availability will determine the extent to which the protocol is applied, MDE may implement or adapt the template based on financial and staff resources.

Virginia Tech proposed that "MDE establish a series of reference sites reflecting a range of disturbance and land use" ...and "select an appropriate and nearby reference site with the same wetland classification or mix of classifications of similar size and which occurs in a similar geologic unit." Virginia Tech notes "If it is deemed desirable to compare wetlands to a least disturbed reference standard wetland of the subject type, the reference site should be (1) relatively unaffected by historic nutrient or contaminant inputs and (2) free of significant soil, hydrologic and vegetation disturbances for at least 25 years." (Daniels et al., 2010)

The number of permanent sample points for soils and hydrology would vary by site size, with a minimum of three points. For wetlands greater than 10 acres in size, Virginia Tech recommends at least 5 sample points. Larger wetlands greater than 50 acres in size would have at least 1 point each 10 acres.

The template includes a technique for measuring sediment accretion, and recommends measuring elevation changes in tidal wetlands in relation to sea level rise to assess long-term sustainability.

Hydrology would be sampled at each point through wells, preferably automated, and piezometers. Wells would measure water depth, and piezometers would measure groundwater flow, recharge, and discharge. The template recommends sampling weekly between February 15- May 15, and monthly from May 15-February 15. Water chemistry would be sampled for total N and total P quarterly for surface and groundwater, at inlet and outlet areas, if present. Sampling should also be performed if there are suspected contaminants.

The template recommends sampling the leaf litter and soils at different depths. For the litter layer, the following is recommended: Dry weight and % ash content; total C; total N; and total P. For soils at 0-5 cm: sample and analyze pH; bulk density ; total C; total N; total P; KCl Extractable ammonium-N and nitrate-N; Mehlich I (dilute double acid) Extractable Ca, Mg, K and P ; and Oxalate-extractable Fe and Al. For subsoils at 20-25 cm, sample and analyze bulk density, pH and Mehlich I nutrients only "unless this sample is being used as the "nutrient input reference" in lieu of an appropriate reference area sample." (Daniels et al. 2010)

Newly created wetlands-IRIS tubes, pre- and post construction monitoring to observe development of redox concentrations or decrease in matrix chroma.

The template recommends sampling vegetation to the species level in late spring and late summer. Sampled strata would be trees, saplings, shrubs, herbaceous, and if appropriate, vines.

For created or restored sites, the sampling should indicate if the species were planted or colonizing.

The template recommends sampling for avian and amphibian species during their breeding seasons. MDE will pursue additional work with Virginia Tech on a general assessment of habitat potential. The objective would be to develop a method to reflect suitability for Maryland's Species of Greatest Conservation Need as well as characteristic species.

Recommended Actions to Be Taken Using Existing Resources (Level 2 and Level 3)

- 1) MDE will begin an evaluation of tidal wetland compensatory wetland mitigation sites.
- 2) MDE will continue assessment of nontidal wetland sites for regulatory purposes with the checklist shown in Appendix D and develop improved guidance and rationale for indicators. Assessments will be completed for all sites visited in the field. MDE anticipates that, in the future, applicants for regulated activities will be required to complete a formal assessment.

Recommended Actions Requiring Additional Resources (Level 2 and Level 3)

- 1) The Natural Resources Conservation Service (NRCS) is seeking funding to collaboratively investigate use of synthetic aperture radar (SAR) to remotely evaluate wetland hydrology pre- and post-restoration.
- 2) Conduct more monitoring of pre-and post activity burns for marsh management (USFWS).
- 3) Conduct long-term monitoring sufficient to improve models of nutrient uptake and transformation in restored and natural wetlands for Chesapeake Bay restoration.
- 4) Seek funding and collaborators to measure success of Phragmites eradication (NRCS).
- 5) Implement long-term monitoring at sample wetland sites across the State and in a variety of land uses.
- 6) Utilize monitoring to evaluate hydrology scope and effect of novel wetland restoration techniques.

QUALITY ASSURANCE

Methods in use will follow previously approved Quality Assurance Project Plans, if applicable. Approved methods for chemical sampling will be noted and referenced to EPA's protocol.

DATA MANAGEMENT

MDE uses a Department-wide enterprise database system for regulatory actions, including, as of late 2009, wetland applications. Wetland application information, proposed and authorized losses, and gains through wetland mitigation are being migrated into this system from RAMS and an internal Microsoft Access database. New regulatory gain and loss information is directly entered into the enterprise system. A GIS-based screening tool that yields a report on proximity of potential wetland impact sites with sensitive species, Tier II waters, watershed, 100-year floodplains, and historical sites will also be linked to the enterprise system. Photographs, plans, and associated documents may be stored with each project in the system.

Reporting capabilities for tracking “no net loss” that may be used in the future for estimated baseline wetland acreage will be developed in the future for the enterprise database. At present, reports on gains and losses are produced from an Access database. Enhancements to the Access database, which is linked to GIS software for graphical depictions of site locations of proposed and authorized wetland activities and mitigation sites, are planned for 2009-2010 to produce reports on wetland functions at authorized impact sites and customized gain/loss information.

A small number of field laptops are used to record information from pre-application and application field reviews in an Access database. These laptops also store screening information, photographs, wetland determination forms, and pdfs, with capability of onscreen editing of pdfs with appropriate software. Due to the cost of these laptops, MDE will investigate use of less costly digital data recorders in the future.

MDE has investigated its existing data storage systems (TEMPO, STORET, and STORET’s successor the Ambient Water Quality Monitoring System (AWQMS) and determined that they will not be suitable for managing comprehensive wetland monitoring data. Too many additional fields and levels for sorting data are required than are in the current systems used by MDE. MDE expects that a new Oracle database will have to be created for the wetlands data, though the system used for storing wetlands data for the National Wetlands Condition Assessment may be suitable or suitable for modification. Links between the new database and TEMPO will be made if data is generated through the permit review process.

The initial level will be for project identification. If data is related to a regulatory action, the agency interest assigned number will be used. Location information, including watershed, will be included.

The second level will be for individual wetlands on the project site. There may be multiple different wetlands sampled under the single project. Wetlands will be classified by the draft MDE system, and by National Wetlands Inventory class. Classification names and codes would be selected from a drop-down box.

The next level will be for individual sample points within each wetland. Latitude/longitude would be recorded. Fields would be created for describing the GPS/survey equipment used and data collection method, and accuracy and equipment limitations. Other fields include those for equipment and methods for soil and water collection and sampling,

wildlife observations, .Additional fields for date, time, most recent precipitation record from nearest rain gauge station would also be used. Wetland identification methods and delineations will generally be standard; different wetland functional assessment protocols may be used and selected from a drop-down list.

Result fields will be numeric, and relate to an accompanying character field. Character fields will include plant lists, soil types, hydric soil indicators, hydrology indicators (source of water to wetland, surface water depth, and depth to groundwater), stressor checklist (includes fields for various alterations to soils, hydrology, vegetation, invasive species, visible trash/pollution). Vegetation coverage and plant size ranges, presence of endangered or threatened species, visible observation of wildlife or wildlife sign, visible indicators of wetland functions. Chemical data for water and soils may also be collected.

Field data recorders are likely to be used. The system will be designed to migrate information to STORET, TEMPO or their successor databases where feasible.

Additional resources are needed to create and maintain the new wetland data base. No source of continued additional funding is currently available, therefore, there is no time frame for building the system.

DATA ANALYSIS/ASSESSMENT

Scoring for nontidal wetland mitigation sites is used to determine success or failure of mitigation sites, area of a site that has achieved partial success. The cause of the failure or resulting low score aids in determining what remediation, if any, will be conducted by MDE for its programmatic sites, or required of permittees.

Analysis and assessment for the Level 3 Template are described in Appendix H.

No use designations and standards specific for wetlands have been adopted. Analysis and listing procedures will be developed as part of the formal regulatory process for adopting water quality standards.

REPORTING

Reports on wetland gains and losses from the regulatory program are generated quarterly, and for annual reports. Data is presented by authorization type and acreage change. Detailed reports on processing times and gains and losses by watershed and wetland type are also prepared to meet requirements of Maryland's State Programmatic General Permit and State reporting requirements.

The new wetland database, if developed according to the concept described in the Data Management section, will be able to generate reports based on any combination of parameters that are entered. The database and reporting capability should be designed to create standard, as well as custom, reports.

PROGRAMMATIC EVALUATION

MDE's objective is to incorporate the wetland monitoring strategy into the overall Maryland State Water Monitoring Strategy. As part of the overall strategy, MDE assembles a workgroup one year prior to each five-year submittal deadline to review Strategy objectives and evaluate options for implementing new priorities over the following ten years. MDE and DNR participate in the Maryland Water Monitoring Council (MWMC). The MWMC serves as a state-wide collaborative body to help achieve effective collection, interpretation, and dissemination of environmental data related to issues, policies, and resource management involving the Maryland water monitoring community. The MWMC provides a number of forums involving local, State and federal government agencies, academia, the private sector, volunteer groups and non-profit organizations involved with water monitoring activities in Maryland. The MWMC provided State officials valuable insights and suggestions in the development of the current Strategy.

MDE is a member of the Mid-Atlantic Wetland Monitoring Workgroup and the National Wetland Monitoring and Assessment Workgroup. The discussions and recommendations through these groups ensure that Maryland is informed of the latest information on wetland monitoring policies, activities, and technical tool development. Annual conferences provide another vehicle for the evaluation of Maryland's monitoring programs. Examples include the annual MWMC conference, the Mid-Atlantic Water Pollution Biology Workshop held in Cacapon State Park, WV, the National Nonpoint Source Monitoring Conference and others.

GENERAL SUPPORT AND INFRASTRUCTURE

This strategy describes actions that may be taken with existing resources within MDE, as of September, 2010, as well as those for which additional resources are needed. The most significant gaps are for ambient monitoring of wetlands to meet Clean Water Act requirements. Additional resources would be needed to implement a long-term monitoring program as described in Appendix H.

There are several programmatic, institutional and fiscal constraints that currently limit Maryland's Comprehensive Water Monitoring Strategy. Some of these constraints are internal to Maryland while others are external and not directly under Maryland's control. These are described in *State of Maryland's Comprehensive Water Monitoring Strategy*.

References

Daniels, W. Lee, and K.C. Haering, J. M. Galbraith, E. Smith, and J.E. Perry, III. 2010. Development of a Level 3 Wetland Assessment Template. Prepared for the Maryland Department of the Environment, Wetlands and Waterways Program. Funded by U.S. Environmental Protection Agency Performance Partnership Grant BG 973027.

Maryland Department of the Environment. 2003. Maryland State Wetland Conservation Plan. Baltimore, MD

Maryland Department of the Environment and Maryland Department of Natural Resources. 2009. State of Maryland's Comprehensive Water Monitoring Strategy.

Maryland Department of Natural Resources. 2005. Maryland Wildlife Diversity Conservation Plan. Annapolis, MD

U.S. Army Corps of Engineers New England District NAEPP 360-1-30a. 1999. The Highway Methodology Workbook Supplement. Wetland Functions and Values: A Descriptive Approach.

