Application of
Elements of a State Water Monitoring and Assessment Program For Wetlands

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Available on the web

http://www.epa.gov/owow/wetlands/monitor/

Introduction

This document was prepared to help EPA and State program managers plan and implement a wetland monitoring and assessment program within the context of the March 2003 EPA document, *Elements of a State Water Monitoring and Assessment Program* (EPA 841-B-03-003). It provides clarification and further information on how the original *Elements* document applies to wetlands. That document recommended ten basic elements of a state water monitoring and assessment program, and serves as a tool to help EPA and the States determine whether a monitoring program meets the requirements of Clean Water Act Section 106(e)(1).

Over the past few years States have made significant progress in developing and implementing monitoring programs that characterize state waters and have contributed to an improved understanding of the condition of wadeable streams nationwide. In developing monitoring programs a number of states have explicitly addressed wetlands assessment. The purpose of this document is to provide specific information on the elements of wetlands monitoring programs for states that are in earlier stages of developing these programs and to promote interstate consistency in reporting progress toward increasing wetland quantity and towards the longer-term goal of improving the quality of the nation's wetlands.

A monitoring and assessment program that is built using these elements will be able to provide managers the information necessary to report on the condition of State wetlands. That information, in turn, can be used to prioritize wetland management activities such as protection, restoration and compensatory mitigation. State implementation of these elements will be an iterative process that is completed over several years. Progress made on one element of activity will influence and advance work being conducted on the other elements.

Organization of this Document

We duplicate the descriptions of each of the 10 elements that make up the Elements of a State Water Monitoring and Assessment Program, and then follow with a description of how to apply that element to wetlands.

The Recommended Elements of a State Program

A) Monitoring Program Strategy

The State has a comprehensive monitoring program strategy that serves its water quality management needs and addresses all State waters, including streams, rivers, lakes, the Great Lakes, reservoirs, estuaries, coastal areas, wetlands, and groundwater. The strategy should contain or reference a description of how the State plans to address each of the remaining nine elements. The monitoring program strategy is a long-term implementation plan and should include a timeline, not to exceed ten years, for completing implementation of the strategy. EPA believes that state monitoring programs can be upgraded to include all of the elements described below by 2014. It is important that the strategy be comprehensive in scope and identify the technical issues and resource needs that are currently impediments to an adequate monitoring program.

EPA recommends that appropriate staff from multiple agencies devise the State's overall water monitoring strategy and integrate wetland monitoring and assessment into it. While the State can develop a separate monitoring strategy for wetlands, it should be coordinated with and referenced in the broader State water monitoring strategy. For example, States that operate under a water monitoring strategy that was finalized during or before 2006 are encouraged to include a description of wetland monitoring and assessment activity in the next scheduled revision of their overall water monitoring strategy. Over time, such program integration will foster the coordination and prioritization of monitoring activities across the various types of waterbodies.

B) Monitoring Objectives

The State has identified monitoring objectives critical to the design of a monitoring program that is efficient and effective in generating data that serve management decision needs. EPA expects the State to develop a strategy and implement a monitoring program that reflects a full range of State water quality management objectives including, but not limited to, Clean Water Act goals.

Likewise, progress made in developing a comprehensive wetland monitoring program will serve many local and State program needs. Some of those wetland program goals include the following:

(1) Establish a baseline of wetland condition and/or report changes in condition in a State's Clean Water Act (CWA) Section 305(b) report or Integrated Report;

(2) Evaluate the environmental consequences of a federal action or group of actions, including the effectiveness of compensatory wetland mitigation, under the provisions of CWA Section 404/401 and the National Environmental Policy Act (NEPA);

(3) Evaluate the performance of wetland restoration projects, including CWA Section 319 nonpoint source pollution control projects;

(4) Evaluate the cumulative effects of wetland loss and/or restoration, and develop watershed plans for the recovery of impaired waterbodies that are listed pursuant to CWA Section 303(d) and;

(5) Refine or create wetland specific water quality standards pursuant to CWA Section 303, including development of appropriate reference conditions.

These objectives should be considered during strategy development along with other state or local objectives. When setting program objectives, EPA expects that the States will focus on measuring both the individual and cumulative environmental effects of management actions so that improvements can be made in those actions over time. Wetland monitoring and assessment should be conducted with the expectation that the information gathered will be used to help support and document the effectiveness of environmental protection and restoration activity.

Each individual objective controls the nature of wetland sampling design, the selection of assessment indicators and sampling methods, field deployment, quality assurance, data analysis, data management, reporting, and the cost of wetland monitoring activity. However, practitioners should avoid the pitfall of assuming that the data quality needs associated with each of the listed objectives are the same. For example, some wetland planning decisions will not need the same high resolution information as is needed for the promulgation of water quality standards that are specific to wetlands.

The remainder of the Strategy should describe the State's approach for achieving the identified objectives including how the State plans to address program gaps or weaknesses.

C) Monitoring Design

The State has an approach and rationale for selection of monitoring designs and sample sites that best serve its monitoring objectives. The State monitoring program will likely integrate several monitoring designs (e.g., fixed station, intensive and screening-level monitoring, rotating basin, judgmental and probability design) to meet the full range of decision needs. The State monitoring design should include a probability-based network for making statistically valid inferences about the condition of all State water types over time. EPA encourages the State to use the most efficient combination of monitoring designs to meet its objectives.

A State should describe in its strategy the monitoring designs that will be used to achieve their wetland management objectives. Below we describe three generally accepted sampling designs for the monitoring and assessment of wetlands.

1. The first is a census that entails examining every unit in the population of interest. Some CWA Section 404 "advance identification actions" (ADID) and "special area management plans" (SAMP) employ this approach to identify significant wetlands in need of specific regulatory attention.

2. The second approach is used for studying an extensive resource, such as all wetlands within a watershed or region. It relies on probability sampling. Studies based on statistical samples rather than complete coverage are referred to as sample surveys.

   Implementing a sample survey involves three primary steps: (1) Creating a list of all units of the target population from which to select the sample; (2) selecting a spatially-distributed, random sample of units from that list; and (3) collecting data from the selected units. The premise behind sample surveys is the ability to characterize and report the overall cumulative condition of wetlands on a broad scale, such as watersheds and regions, without sampling each wetland. The results of sample surveys also allow a State agency to prioritize areas where more targeted sampling efforts are needed to meet a particular objective. Developing a probability-based sampling design is a rigorous task. EPA can provide technical assistance in designing this type of a monitoring program and in analyzing the resulting data.

3. The third approach relies on best professional judgment to target sampling within specific wetlands for purposes of comparison. A common use of targeting sampling is to characterize wetland condition and function along a gradient of human disturbance in order to establish reference wetland condition. Many rapid assessment methods use this design approach. Improvements to the assessment methods are then made using supplemental data gathered through the use of a probability-based sampling approach.

Also, a State strategy should identify the type of wetland classification system and mapping system they intend to use as part of their sampling design. They should also describe how they intend to complete or update the wetland inventory maps needed to conduct monitoring and assessment activity. States are encouraged to closely coordinate with EPA Regional staff on this matter in order to keep apprised of related work being conducted by the Federal Geographic Data Committee (FGDC). More information about the FGDC can be found at: *http://www.fgdc.gov/*.

Characterization of wetland reference condition

The characterization of wetland reference condition is an important step in the design of a wetland monitoring and assessment program. The ecological understanding that is derived from the characterization of reference sites can be extrapolated to other sites to meet a specified set of assessment objectives. In a practical sense, that extrapolation is achieved through the development, verification and use of wetland assessment methods. Steps to characterize reference condition include:

- Prioritize watersheds or other geographical areas to be surveyed to meet a given wetland monitoring and assessment objective.

- Identify specific wetland classes within prioritized watersheds targeted for assessment, and identify the domain (sample frame) for each selected type. Consider the hydrogeologic or

ecoregion setting, wetland inventory, wetland hydrogeomorphic (HGM) and Cowardin classification and the overall wetland landscape profile. A wetland landscape profile represents the abundance, by class, of wetlands that occur in a geographical area.

- Select and verify indicators that are used to assess wetland condition, relative to wetland beneficial use and function. Verification can be achieved based on a preponderance of scientific information (i.e., "weight of evidence") that is systematically gathered at wetland reference sites.

- Establish a reference network that: (a) Reflects a gradient of human-induced disturbance, and includes both least-impacted sites and other sites, and (b) can be sampled to verify the accuracy of wetland assessment methods. Long-term sampling conducted within the reference network will provide information needed to characterize wetland variability over time and space.

D) Core and Supplemental Indicators (and Methods)

Note: EPA has training modules and websites containing detailed information on monitoring design, assessment indicators and methods. For further information, please visit: http://www.epa.gov/waterscience/criteria/wetlands/.

Because limited resources affect the design of water quality monitoring programs, the State should use a tiered approach to monitoring that includes a core set of indicators selected to represent each applicable designated use, plus supplemental indicators selected according to site-specific or project-specific decision criteria.

The development of wetland assessment methods, and in particular a rapid wetland assessment method, is a prerequisite to accomplishing many program objectives. Figure 1 (next page) shows a conceptual model that identifies the core indicators and metrics used in wetlands assessment. The indicators and metrics reflect the ecological factors (or attributes) that define wetlands (i.e., hydrology, soils and biota) and how those factors respond to human-induced disturbance (i.e., stressors). Indicators of wetland condition can be based either on the response of a wetland to stressors or on the stressors themselves.

In particular, environmental indicators are used in making determinations of whether wetland function is changed or lost to the point of affecting wetland condition. In turn, the condition of wetlands affects their capacity to support a beneficial use (e.g., aquatic life use support, including wildlife habitat). The choice of indicators (and associated metrics) depends on the purpose of monitoring and level of accuracy needed for decision-making. For example, a set of core indicators can be used to characterize wetland condition in terms of ecological integrity. Supplemental indicators can then be used to characterize a wetland's special significance as critical or outstanding wildlife habitat. Wetland indicators, and their associated metrics, are often portrayed in wetland assessment methods as an organized set of assessment questions.

Figure 1

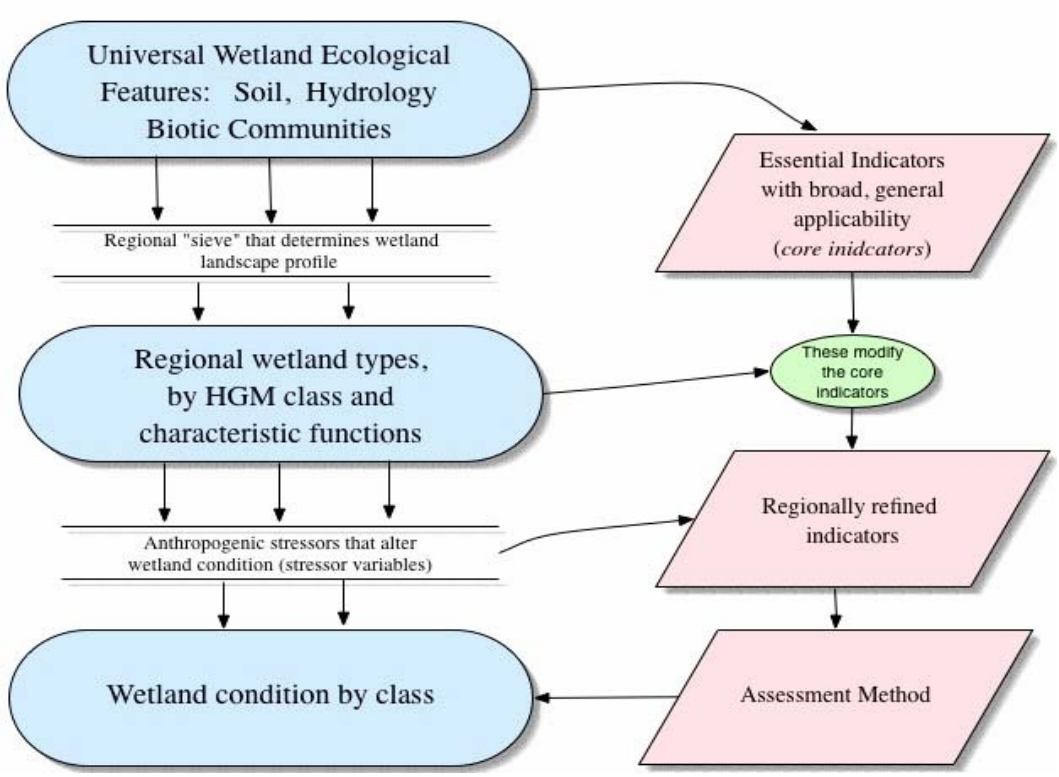

Table 1 (next page) presents three types of wetland assessment methods that can be developed to support program objectives. The method selected will depend on the availability of resources for project deployment and the desired level of rigor needed for project reporting and decision-making.

Work may begin on the development and verification of any of the three types of assessment methods, but should reflect identified monitoring objectives. For example, rapid wetland assessment methods (Level 2) that are developed using best professional judgment can be tested using results from more intensive wetland monitoring activity (Level 3). Results from both Level 2 and Level 3 assessments can be used to enhance the utility or test the efficacy of landscape scale (Level 1) assessments. The three types of assessment are generally described as:

Level 1 - Landscape Assessment

These assessments rely almost entirely on Geographic Information Systems (GIS) and remote sensing data to obtain information about watershed conditions and the distribution and abundance of wetland types in the watershed. Wetland (acreage) trends analysis that is conducted by the U.S. Fish and Wildlife Service's National Wetland Inventory (NWI) is a Level 1 type of assessment.

Also, wetland landscape profiles and landscape development indices are used in ”Level 1" assessments. Landscape development indices (LDI) involve the characterization of lands that surround assessed wetlands, including their buffer. Metrics used in the LDI approach, such as road density, percent forest cover, land use category, and presence of drainage ditches, can provide preliminary information on wetland condition within a watershed. Field-based monitoring efforts (Level 2 and 3) can be targeted within parts of a watershed and to specific wetlands in need of more rigorous assessment.

Table 1

3-Level Technical Approach

	Products/Applications
Level 1 - Landscape Assessment: Use GIS and remote sensing to gain a landscape view of watershed and wetland condition. Typical assessment indicators include wetland coverage (NWI), land use and land cover	•Targeting restoration and monitoring •Landscape condition assessment •Status and trends •Integrated reporting CWA 305(b)/303(d)
Level 2 – Rapid Wetland Assessment: Evaluate the general condition of individual wetlands using relatively simple field indicators. Assessment is often based on the characterization of stressors know to limit wetland functions e.g., road crossings, tile drainage, ditching.	•401/404 permit decisions •Integrated reporting •Watershed planning •Implementation monitoring of restoration projects, including nonpoint source BMPs,and Farm Bill programs
Level 3 – Intensive Site Assessment Produce quantitative data with known certainty of wetland condition within an assessment area, used to refine rapid wetland assessment methods and diagnose the causes of wetland degradation. Assessment is typically accomplished using indices of biological integrity or hydrogeomorphic function.	•WQS development, including use designation • Integrated reporting •Compensatory mitigation performance standards •Verify levels 1 and 2 methods

Level 2 - Rapid Assessment

Rapid assessments use relatively simple metrics for collecting data at specific wetland sites. These methods should provide a single rating or score that shows where a wetland falls on the continuum ranging from full ecological integrity (or least impacted condition) to highly degraded

(poor condition).

A "rapid" method should take two people no more than four hours of field time, and one half day of office preparation and data analysis to reach a condition score. Once verified with "Level 3" site intensive assessments, rapid assessment methods can be used for regulatory decision making, local land and water use planning, and the assessment of ambient wetland condition.

Level 3 - Intensive Site Assessment

This is a more rigorous, field-based method that provides higher resolution information on the condition of wetlands within an assessment area, often employing wetland bioassessment procedures (i.e., indices of biological integrity "IBI") or HGM functional assessment methods.

The robust metrics used in "Level 3" assessments produce information that can be used to (a) refine rapid assessment methods based on a characterization of reference condition, (b) diagnose the causes of wetland degradation, (c) develop design and performance standards for wetland restoration, including compensatory wetland mitigation, and (d) support the development of water quality standards that are protective of wetlands.

E) Quality Assurance

Wetlands monitoring programs will include Quality Management Plans and Quality Assurance Project Plans (QAPP), maintained and peer reviewed in accordance with EPA Policy to ensure the scientific validity of monitoring and laboratory activities. These plans are used to prevent the introduction of both random and systematic errors into data analysis and reporting. They ensure the scientific validity of sampling, laboratory, and data analysis and reporting activities.

QAPPs should reflect the level of data quality appropriate for specific uses of data (e.g., reporting status and trends, prioritizing restoration activity and assessing the performance of compensatory mitigation projects). In particular, States should be careful not to assume that a QAPP developed for the monitoring and assessment of streams, lakes or estuaries is directly suitable for wetlands.

For example, new State wetland monitoring programs will likely conduct a significant amount of testing on assessment indicators and methods. Some of that testing work will be accomplished during the actual implementation of wetland survey projects. For that situation, the overall project QAPP would have to explain how acquired sampling data would be used to independently verify the efficacy of methods used in the survey, as well as to document the statistical certainty of survey results.

In general, a QAPP can be thought of as a guide, a work plan, or a wetland sampling plan used to ensure scientific validity and provide consistency between field crews, sampling seasons, and differing sample sites. It can keep a project team on task so that they will produce timely and defensible results.

F) Data Management

The State uses an accessible electronic data system for water quality, toxicity, sediment chemistry, habitat, and biological data (following appropriate metadata and State/Federal geo-locational standards) with timely data entry and public access.

The State should also have the capability of managing available geospatial data for wetlands for use in Geographical Information System (GIS) applications (e.g., "Level 1" wetland assessment). Monitoring and assessment should be conducted with the intent that collected data and analyzed data will be archived to allow for its use in future studies. The selection of a data management system should be planned in the initial phases of a monitoring project and program.

EPA encourages States to enter wetland monitoring data into EPA's central water quality data warehouse (See: *http://www.epa.gov/storet/*). The "STORET" data warehouse is used by State environmental agencies, EPA, other federal agencies, universities, and others for the exchange of data of known quality. Over time, all wetland survey data gathered by the States should be entered into the warehouse. For States that do not currently enter their data into the water quality data warehouse, monitoring strategies should indicate that entry will be accomplished as quickly as possible. The entry of data gathered from a reference wetland network is a reasonable first step toward accomplishment of that goal.

The EPA is committed to working with States to provide training and technical support in the use of the STORET data warehouse. That partnership will help improve data sharing and reduce the cost of wetland monitoring by minimizing duplicative sampling among states. For example, neighboring states that share ecoregions and similar wetland classes may be able to use existing, stored data to assess wetland reference condition and thereby build a common set of wetland assessment methods.

In addition, the State should store its wetland assessment information in an accessible electronic database. EPA strongly recommends that all States use either the Assessment Database (ADB) or an equivalent database. The ADB is a relational database application for tracking water quality assessment information, including use attainment, and causes and sources of impairment. It is the basis of Clean Water Act Section 305(b)/Integrated Reporting.

The ADB supports three principal functions:

- Improve the quality and consistency of water quality reporting;
- Reduce the burden of preparing reports under Clean Water Sections 305(b), 303(d), 314, and 319 of the Clean Water Act (CWA); and
- Improve water quality data analysis.

As such, it serves as an analytical tool for States in the process of developing water quality standards that are specific to wetlands. For more information about the ADB, visit *http://www.epa.gov/waters/adb/index.htm.*

G) Data Analysis/Assessment

Data analysis procedures include the design and use of field data sheets and the specification of statistical/graphical analysis methods. The documentation of procedures, prior to environmental sampling, ensures monitoring and assessment data are produced and analyzed in a timely and cost effective manner. It also ensures that the rigor of wetland sampling and analysis is conducted in a manner that is commensurate with that needed for a particular type of decision-making. For example, the quality of assessment results needed for general wetland resource planning may differ from the quality needed for water quality criteria development.

States should document or reference their wetland data analysis and assessment procedures in their Strategy and relate them to the objectives identified under "Element B - Monitoring Objectives." The strategy also should describe the data analysis procedures that will be used to characterize a wetland or wetlands relative to an established reference condition.

H) Reporting

The State produces timely and complete water quality and wetland condition reports. EPA expects that wetland monitoring and assessment will be conducted to specifically inform wetland management decisions. The intended user group, format, style and peer review requirements of project reports should be identified in the initial phases of a monitoring and assessment project.

The EPA encourages all States to enter wetland assessment results produced from ambient monitoring surveys into EPA's Assessment Database (ADB), as mentioned in "Element F." Information entry may include an interpretation of those results and narrative describing how the reported information will be used to inform wetland management decisions.

All available wetland assessment information should be included in the State CWA Section 305(b)/Integrated Report. That report, which draws upon information from the Clean Lakes Program, nonpoint source program, CWA Section 303(d) listed waters and other assessments, is the primary State monitoring program report to EPA. Integrated Reporting guidance is available at *http://www.epa.gov/owow/tmdl/2006IRG/.*

The EPA also is interested in partnering with the States to integrate wetland monitoring and assessment information with CWA Section 404/401 permit tracking systems. Several such

systems are currently under development by the U.S. Army Corps of Engineers and the States.

I) Programmatic Evaluation

The State, in consultation with its EPA Region, conducts periodic reviews of each aspect of the monitoring program to determine how well the program serves its water quality decision needs for all State waters, including all waterbody types. The internal audits will identify gaps in information production that can be filled as a program matures. Program evaluation may consist of a periodic program review by a technical or policy advisory committee. During periodic review, the EPA expects that States will document how wetland monitoring and assessment information is used to produce beneficial environmental outcomes (e.g., prioritize wetland protection and restoration to aid recovery of impaired waterbodies, develop design and performance measures for compensatory wetland mitigation projects). The review also provides an opportunity to identify contingencies that will allow wetland monitoring and assessment activity to continue in the event of a funding shortfall.

J) General Support and Infrastructure Planning

The State identifies current and future monitoring resources needed to fully implement its monitoring program strategy including those components that are not yet in place. The start-up of a wetland monitoring and assessment program will likely occur at geographical locations where there are wetlands at risk, discretionary dollars, interested people and existing data. Work at those locations should take into account the logistics and budget resource needs relative to project staffing, training, field operations (e.g., access to private properties), laboratory needs and
office operations (e.g., access to existing information, data management and analysis). The actual costs of such projects should be documented in terms of both money and time. Such budget documentation forms the basis for future funding requests and project plans.

All needs should be assessed and discussed with EPA Regional staff during the preparation of proposals for CWA Section 104(b)(3) grants, 106 grants and/or Performance Partnership Grants.