



Watershed Protection: A Statewide Approach
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Executive Summary

The Watershed Protection Approach is a strategy for effectively protecting and restoring aquatic ecosystems and protecting human health. This strategy has as its premise that many water quality and ecosystem problems are best solved at the watershed level rather than at the individual waterbody or discharger level. The Watershed Protection Approach has four major features: targeting priority problems, a high level of stakeholder involvement, integrated solutions that make use of the expertise and authority of multiple agencies, and measuring success through monitoring and other data gathering.

One framework that states use to implement the Watershed Protection Approach focuses on organizing and managing by the state's major watersheds, which are called basins in this document. This flexible framework encompasses management and protection of ecosystems and human health at three levels: the state, the basin, and the watersheds within each basin. Some issues are best addressed at the watershed level, such as controlling nutrient loading to small lakes or restoring headwaters riparian habitat quality. Other issues may be best addressed at the basin level, such as phosphate detergent bans, wetlands mitigation banking, or nutrient trading. Still other activities and solutions are best implemented at the state level, including policies on toxics control or the operation of permit programs.

To be comprehensive, the approach requires consideration of all environmental concerns, including needs to protect public health (including drinking water), critical habitats such as wetlands, biological integrity and surface and ground waters. This involves improved coordination among federal, state and local agencies so that all appropriate concerns are represented. Such involvement is especially important to integrate emerging programs such as ground water protection with older program frameworks. So, for example, the concerns addressed through Comprehensive State Ground Water Protection Programs (CSGWPPs), Wellhead Protection Programs, National Estuary Programs or State Management Plans for Pesticides would be considered along with concerns addressed by wetlands protection programs and our more traditional programs for point and nonpoint source pollution prevention and control. The state experiences on which this document are based reflect different levels of integration. Thus, although the document is based on their experiences, it does attempt to identify opportunities for incorporating a truly comprehensive approach.

A number of states, for example, are developing watershed approaches and CSGWPPs tailored to their priorities and individual local conditions. Together, these approaches will serve as a broad framework for facilitating surface and ground water coordination and, ultimately, will involve all appropriate state agency staff in setting goals, establishing priorities, convening and overseeing watershed teams and implementing integrated and effective solutions.

What Does Managing by Watersheds Entail?

A statewide watershed approach, as described in this document, is an approach to managing water quality by major hydrologic units. Typically, activities such as monitoring, planning, and permitting are conducted according to a set schedule (e.g., monitoring in years 1 and 2, data analysis and modeling in year 3, plan development in year 4, permit issuance and plan approval in year 5). Several state approaches have other elements in common as well:

- *Management units* -- Large hydrologic units (e.g., major river basins or aquifers) are delineated by the state; each "basin" contains multiple watersheds.
- *Management cycles* -- A state's basins are grouped in sequence so that the entire state is studied, and management plans developed, in a set period (typically, 5 years).
- *Stakeholder involvement* -- Agencies, organizations, and individuals interested in the water quality, ecosystem health, and management strategies are included in watershed management activities.
- *Strategic monitoring* -- Water quality and ecological health are monitored to measure the extent of problems and the stressors involved; this is typically done on a rotating basis (e.g., two summers of sampling every 5 years for a given basin).
- *Assessment* -- Data analysis and professional judgment are used to identify problems, sources, and stressors; water quality standards are integral to assessments because they reflect criteria for restoring and maintaining the physical, chemical, and biological integrity of water.
- *Prioritization and targeting* -- Waterbodies or watersheds are ranked according to resource value, degree of impairment, and other factors; specific watersheds or waterbodies are targeted for special management attention.
- *Development of management strategies* -- Realistic goals are set for the basin and its watersheds; management strategies are then developed before allocating scarce resources.
- *Basin or watershed plans* -- These plans document the assessment results, goals, and chosen management strategies for each basin or watershed; a plan may be issued in conjunction with National Pollutant Discharge Elimination System (NPDES) permits and revised periodically (e.g., every 5 years); the plan also serves to educate the public on basin-specific issues.
- *Implementation* -- Selected management strategies are implemented in the years between updates of the plan.

Why Implement a Watershed Protection Approach?

Watershed protection provides states with a framework for protecting their watersheds and addressing all priority problems, not just those most readily solved. States already implementing a Watershed Protection Approach anticipate many benefits, including:

- More direct focus by stakeholders on achieving ecological goals and water quality standards rather than on measurement of program activities such as numbers of permits or samples
- Improved basis for management decisions through consideration of both traditional stressors (e.g., toxics from point sources, biochemical oxygen demand, nutrients) and nonchemical stressors (e.g., habitat loss, temperature, sediment, low flow)
- Enhanced program efficiency because activities such as monitoring or permit writing are focused on a limited number of watersheds at a time
- Improved coordination among federal, state and local agencies and other organizations, including increased data sharing and pooling of resources
- Enhanced public involvement, including better relations with permittees due to increased involvement and greater consistency and equitability in permit conditions
- Innovative solutions such as ecological restoration, wetlands mitigation banking, and market-based solutions (e.g., pollutant trading or restoration in lieu of advanced wastewater treatment).

How Does a State Get Started?

Switching from program-centered to watershed management is a major *functional* change for most state agencies, although it need not involve a change in *organizational structure*. Strong commitment of high-level management is essential, as is strong leadership on the part of the individual(s) appointed to direct implementation. Important first steps include budgeting sufficient time for key staff who will develop the approach, educating all parties on the principles of watershed management, and establishing an efficient means of communication among staff. Several states have used outside facilitators to bring staff from various program areas together to agree on common purposes and work out potential "turf" issues.

The lead agency should consider preparing a detailed framework document that describes overall goals and objectives, the basin cycle, basin-specific schedules, roles and responsibilities of each organizational unit, procedures for developing plans, and guidelines for public involvement.

Any Watershed Protection Approach must be tailored to suit the state's particular situation. State officials can benefit from reviewing the framework documents and, in some cases, watershed management plans from states such as North Carolina, South Carolina, Nebraska, Delaware and Washington.

How Does Ground Water Protection Fit?

Ground water and surface water are often directly connected, with water flowing back and forth from one resource to the other over time. The quality of ground water contributes to the overall condition of the watershed, and ground water may serve as a medium for transporting pollutants to surface waters (and vice versa). In many instances, the Watershed Protection Approach is an appropriate framework for integrating surface water and ground water protection.

In other instances, ground water protection presents challenges that differ from those encountered in protecting surface waters. For example, because ground water is so expensive and difficult to clean up, there is heavy emphasis on prevention. Other dissimilarities between the two resources include differing transport mechanisms, monitoring approaches and resource boundaries (e.g., aquifer boundaries may not coincide with basin or watershed boundaries).

A truly comprehensive statewide approach, therefore, must be designed to address specific concerns about ground water in addition to concerns about surface water. These concerns include how to address immediate and ongoing ground water program priorities such as wellhead protection with a state's Watershed Protection Approach. CSGWPPs provide states with the opportunity to implement an aquifer protection approach that integrates well with a Watershed Protection Approach. CSGWPPs incorporate the principles of the Watershed Protection Approach in that they are place-based, include the relevant stakeholders, consider multiple environmental objectives and give the leading role to states. CSGWPPs play an important part in tailoring all water programs to meet specific needs within watersheds at the local, state and federal levels.

Foreword

The Watershed Protection Approach (WPA) is a departure from the way the EPA has traditionally operated its water quality programs and how federal, tribal, and state governments have typically approached natural resource management. Resource management programs -- programs for wetlands protection, wastewater discharge permitting, flood control, farmer assistance, drinking water supply, fish and game management, and recreation -- have tended to operate as individual entities and occasionally at cross purposes.

We now generally recognize that the critical environmental issues facing society are so intertwined that a comprehensive, ecosystem-based approach is required. We also recognize that solving environmental problems depends increasingly on local governments and local citizens. Thus, the need to integrate across traditional program areas (e.g., flood control, wastewater, land use) and across levels of government (federal, state, tribal, local) is leading natural resource management toward a watershed approach.

One emerging framework for a statewide Watershed Protection Approach focuses on organizing and managing by a state's major watersheds, which are called basins in this document. In this statewide approach, activities such as water quality monitoring, planning and permitting are coordinated on a set schedule within large watersheds or basins. Involvement of other natural resource agencies is actively sought to achieve water quality and ecosystem goals.

This document is one of two guides to watershed protection designed for state water quality managers. A second guide, *Watershed Protection: A Project Focus*, describes another aspect of the Watershed Protection Approach -- developing projects for the individual watershed. It provides a blueprint for designing and implementing watershed projects, including references and case studies.

I trust this Watershed Protection Approach document will provide a useful guide for state water quality managers and others involved in watershed-based activities as they adopt, implement and evaluate watershed protection programs.

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Chapter 1. The Watershed Protection Approach

1.1 Historical Perspective

The concept of water resources management within watersheds originated as early as the 1890s with the work of the U.S. Inland Waterways Commission. The Commission, with the backing of President Roosevelt, reported to Congress in 1908 that each river system -- from its headwaters in the mountains to its mouth at the coast -- is an integrated system and must be treated as such (Inland Waterways Commission, 1908). The focus of water resources management then and throughout the first half of the century was on efficient use of water resources for such purposes as energy production, navigation, flood control, irrigation, and drinking water.

The 1950s and 1960s saw increased emphasis on improving ambient water quality and protecting the Nation's drinking water, much of which comes from ground water. The Federal Water Pollution Control Act of 1956 provided large-scale funding of publicly owned treatment works. The Water Quality Act of 1965 required states to develop water quality standards for interstate waters. River basin compacts were formed to protect major systems such as the Delaware and Colorado Rivers. Some state sanitation commissions adopted a river basin approach to their work. They developed basin plans that classified individual waterbodies according to their best uses. These early water quality managers walked, boated, and drove throughout entire river basins, documenting outfall pipes and collecting ambient samples.

1.2 The Clean Water Act

In 1972, the Federal Water Pollution Control Act Amendments (PL92-500) established as a national goal the restoration and maintenance of the physical, chemical, and biological integrity of the Nation's waters. The dominant features of this Clean Water Act (CWA) were a Federal permitting program (the National Pollutant Discharge Elimination System or NPDES) and massive funding for wastewater treatment and state water quality programs. Under NPDES, each discharger receives a permit containing numerical effluent limits that are, at a minimum, based on best available wastewater treatment technology or other guidelines (technology-based limits); more stringent limits are issued where needed to take into account the condition of the waterbody (water quality-based limits).

Under Section 303(e) of the CWA, states prepared basin plans for controlling their point source problems. These plans consolidated most known information about dischargers and water quality and helped form the basis for grant decisions for wastewater treatment. Mathematical models were used to determine allowable loads from municipal and industrial treatment plants. However, after the initial plans were completed, most states maintained only a limited basin planning function while focusing on individual point source problems.

The CWA also set the stage of early ground water protection efforts. Under Section 102, EPA, states and other federal and interstate agencies are authorized to develop comprehensive programs to reduce, prevent and eliminate pollution to ground water and surface waters. This authority, and the Resource Conservation and Recovery Act, the Federal Insecticide, Fungicide,

and Rodenticide Act and other laws provided for the initiation of Comprehensive State Ground Water Protection Programs (CSGWPPs).

In the 1987 amendments to the CWA, Congress required states to expand their programs for dealing with toxicants, nonpoint sources (NPSs), wetlands, water quality standards and other topics. These requirements have strained state budgets and made multi-agency programs such as NPS management more difficult to coordinate effectively. Moreover, the states' progress in eliminating point source pollution has revealed that NPS pollution and habitat degradation account for most of the Nation's remaining water quality problems (U.S. Environmental Protection Agency [EPA], 1994a).

1.3 The Safe Drinking Water Act

The 1974 Safe Drinking Water Act (SDWA) drew together several important programs protecting public health that now need to be considered within a comprehensive Watershed Protection Approach. Then, in the late 1970's, hazardous waste sites were found to be affecting public water systems. Some of these sites suffered from surface water intrusion and contaminated ground water discharge. The 1986 amendments established further the basis for protecting ground water supplying drinking water to public water systems and private users. The types of contaminants that must be removed by drinking water systems was quadrupled. The requirements for testing this expanded list of contaminants impose significant costs on State and local drinking water monitoring programs.

EPA has also established the Source Water Protection and Wellhead Protection Programs under the SDWA. Source Water Protection emphasizes preventing contamination of drinking water resources and includes wellhead protection and sole source aquifer watershed control plans. The Wellhead Protection Program sets priority on contamination to ground waters that will provide drinking water in the next 5 to 20 years. It relies upon hydrologic models of ground water flow to define the protection area which may include the portion of the stream and the watershed upstream from the well. The Sole Source Aquifer Program allows the public to define entire aquifers that provide at least half the population's drinking water, whether for public or private use. Watershed control plans under the surface water treatment rule are used to define the area providing drinking water to a public water system experiencing microbial contamination. The area is to be managed to reduce or eliminate contaminant sources.

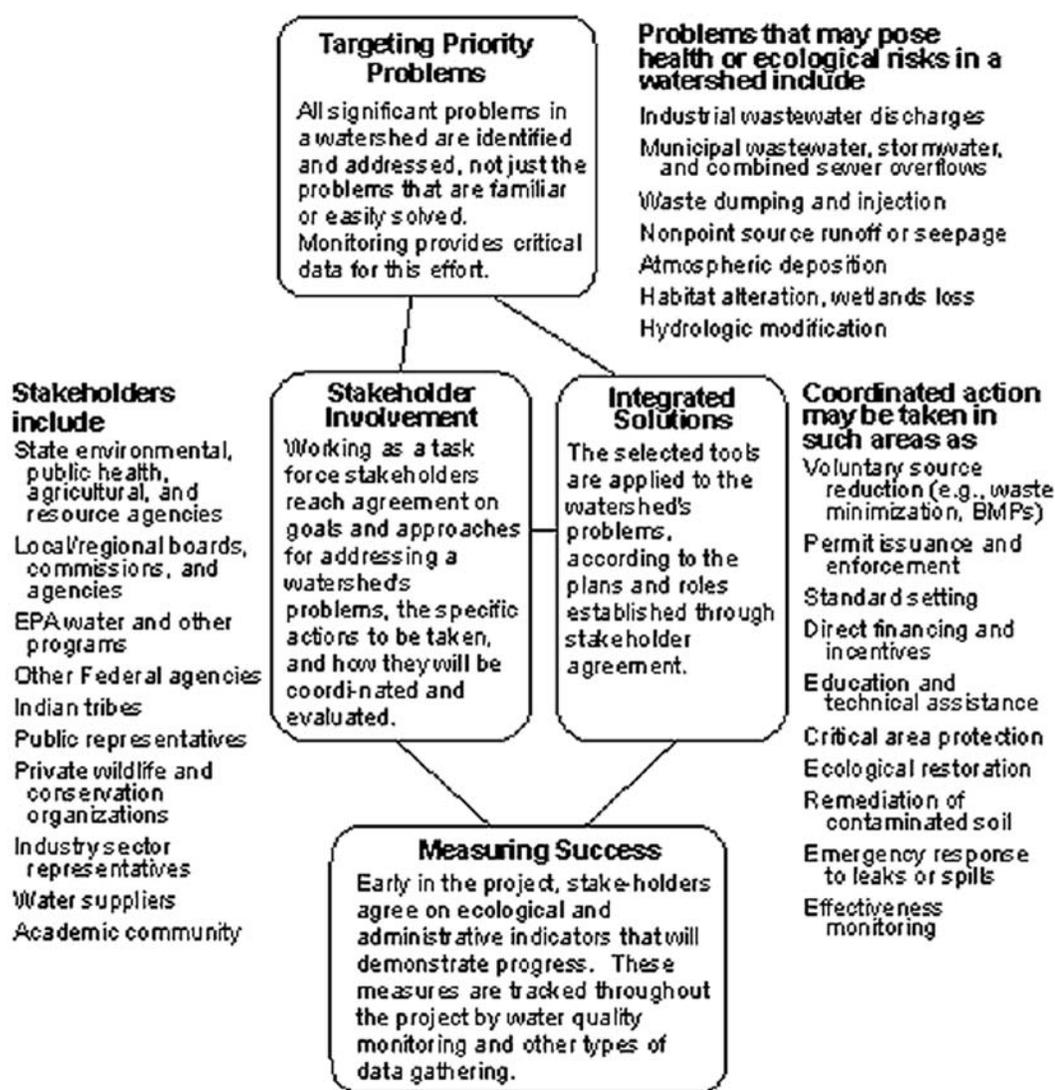
1.4 The Watershed Protection Approach (WPA)

A comprehensive approach to water resource management is needed to address the myriad water quality problems that exist today from nonpoint and point sources as well as from habitat degradation. The WPA is a management approach for more effectively protecting and restoring aquatic ecosystems and protecting human health. The EPA Office of Water is using this approach to focus on hydrologically defined resource areas -- watersheds and aquifers. The WPA recognizes that water quality management must embrace human and ecosystem health and that managing for one without considering the other can be detrimental to both. The WPA allows managing a range of inputs for specific outputs. It emphasizes all aspects of water quality including chemical water quality (e.g., toxicants and conventional pollutants), physical water

quality (e.g., temperature, flow, circulation, ground and surface water interaction), habitat quality (e.g., channel morphology, substrate composition, and riparian zone characteristics), biological health and biodiversity (e.g., species abundance, diversity, and range) and subsurface bio-geochemistry.

The WPA has four major features: targeting priority problems, stakeholder involvement, integrated solutions, and measuring success (Figure 1-1). It is important to note that the WPA is not a new program that competes with or replaces existing water quality programs; rather, it is a framework within which ongoing programs can be integrated effectively. Further, a watershed approach can provide benefits to individual citizens and the public and private sectors.

Figure 1-1. Features of the Watershed Protection Approach



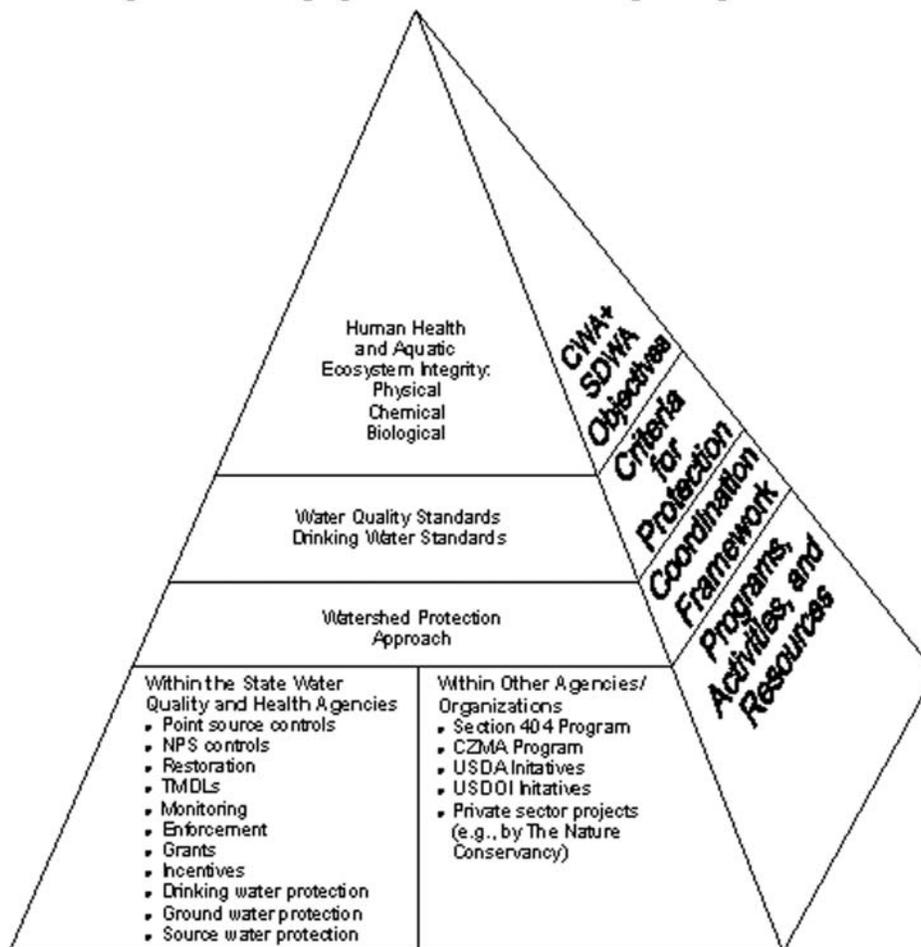
Individual citizens benefit because watershed protection improves the environment. The public sector benefits because agencies can accomplish more through cooperation with other stakeholders than they can on their own with limited resources. The participation of local organizations ensures that those who are likely to be most familiar with a watershed, its problems, and possible solutions play a major part, often a leadership role. The private sector can benefit because the burden of water resource protection is distributed more equitably among pollution sources. All stakeholders benefit because they can participate in decisionmaking that is based on a comprehensive assessment of the watershed including all interacting aquifers.

The features of the WPA shown in Figure 1-1 include a strong monitoring and evaluation component. Using monitoring data, stakeholders identify stressors that may pose health and ecological risk in the watershed and any related aquifers, and prioritize these stressors. Monitoring is also essential to determining the effectiveness of management options chosen by stakeholders to address high-priority stressors. Because many watershed protection activities require long-term commitments from stakeholders, stakeholders need to know whether their efforts are achieving real improvements in water quality.

Figure 1-2 illustrates how the WPA fits into the context of CWA implementation by a state water quality agency. The peak of the pyramid represents the goal of restoring and maintaining ecosystem integrity for human and aquatic health. Water quality standards and other environmental objectives are the measures of ecosystem integrity that comprise the next level of the pyramid. As suggested by its position in the pyramid, one purpose of the WPA is to integrate the many individual programs that have evolved to implement the goals of the CWA (e.g., to restore, protect and maintain the physical, chemical and biological integrity of the Nation's waters) and the SDWA (e.g., to protect human health through source water protection).

CWA Section 303(d) and the Total Maximum Daily Load (TMDL) process provide one key legislative and technical underpinning for the WPA. A TMDL may involve all of the actions or programs shown: point and nonpoint source controls, monitoring, and restoration. Similarly, SDWA programs for Source Water Protection and Wellhead Protection can be key components of the WPA. Each state may make more or less use of each of these CWA and SDWA programs, tailoring them to create its unique watershed approach. Various sources of funding may be brought to bear to carry out the WPA (e.g., federal grants, state appropriations, and permit fees).

Figure 1-2. Emerging framework for achieving CWA goals.



The pyramid includes initiatives by other agencies as integral components of a WPA. Examples within the U.S. Department of Agriculture include the Natural Resources Conservation Service (NRCS; formerly the Soil Conservation Service or SCS) Small Watersheds Program; another NRCS initiative to delineate consistent watersheds nationwide; and the U.S. Forest Service's South Fork Salmon River Project, where restoration efforts seek to mitigate sediment impacts from past livestock grazing, logging, and road building activities.

The WPA has evolved over the past several years. In 1991, EPA produced an initial framework document that discussed EPA's concept for watershed protection and outlined EPA's potential role in watershed protection efforts (U.S. EPA, 1991). Since that time, EPA has provided support to states and other entities to help build on the many existing regional, state, and local watershed-based programs and watershed projects. Following extensive consultation with the States, EPA issued its National Guidance for Comprehensive State Ground Water Protection Programs (U.S. EPA, 1993a). EPA has worked with many other Federal agencies to harmonize the WPA with other agency approaches. EPA has jointly and singly sponsored numerous conferences on watershed management.

Point source controls and other traditional approaches to water quality management have been effective to date in resolving many of our Nation's water quality problems. The WPA provides a flexible model for tackling the complex environmental problems that we still face today. In addition, the growing number of water resource programs with overlapping functions requires the coordination and integration that a watershed approach can provide. A watershed approach also allows new partnerships to form among federal, state, and local agencies, citizens, and the private sector that are focused on a specific resource. Finally, the WPA's emphasis on stakeholder participation fosters a sense of ownership and stewardship of local resources.

1.5 Managing by Hydrologic as Well as Political Units

Watershed boundaries seldom if ever coincide with jurisdictional boundaries such as state, county or town lines. Like watersheds, aquifers too are natural hydrologic units that seldom match jurisdictional boundaries but have unique management needs. This has long presented a special challenge to local and state water resource managers whose geographic areas of responsibility are politically rather than hydrologically based. It further complicates matters that watersheds occur on a range of scales from the sub-national or regional (e.g., the Mississippi watershed) down to local scale (e.g., the watershed of a small creek). At any scale, watersheds and aquifers function as natural systems within which resource managers and stakeholders can work to establish and maintain the best possible combination of ecological condition and human health and welfare.

It is possible to organize watershed management around watersheds at scales large or small. In an average state, there may be ten or more major watersheds containing several hundred moderately-sized watersheds, and thousands of still smaller watersheds within these. Given the variety of scales and geographic units available, then, how can state resource managers best implement their programs on watershed management units?

One framework that states use to implement the WPA focuses on organizing and managing by the state's major watersheds, which are frequently called basins in this document. This flexible framework encompasses management and protection of ecosystems and human health at three levels: the state, the basin, and the watersheds (and aquifers) within each basin. Some issues, such as controlling nutrient loading to small lakes or restoring headwaters riparian habitat quality, are best addressed at the local watershed level. Other issues may be best addressed at the basin level, such as phosphate detergent bans, wetlands mitigation banking, or nutrient trading. Still other activities and solutions are best implemented at the state level, including policies on toxics control or the operation of permit programs.

Typically, the state's basins and selected major aquifers become the primary management units in this framework. Program activities such as permitting, monitoring, modeling, and water quality planning are scheduled for each basin on a rotating five-year cycle covering all the state's basins. Other activities such as compliance and enforcement are ongoing throughout the cycle. Products include an initial state framework document describing this approach and individual basin management plans that are updated every five-year cycle (Figure 1-3).

When states manage by basins, their programs are organized around a limited and manageable number of major watersheds occurring within the state. Basin-level activities can be coordinated more broadly with statewide actions and policies, or more locally with watersheds of concern within a basin. This approach can be an improvement on past approaches to water resources management because it compels managers to focus on systems (basins, watersheds and aquifers), how well these systems are working, and how the management needs for these systems differ from watershed to watershed.

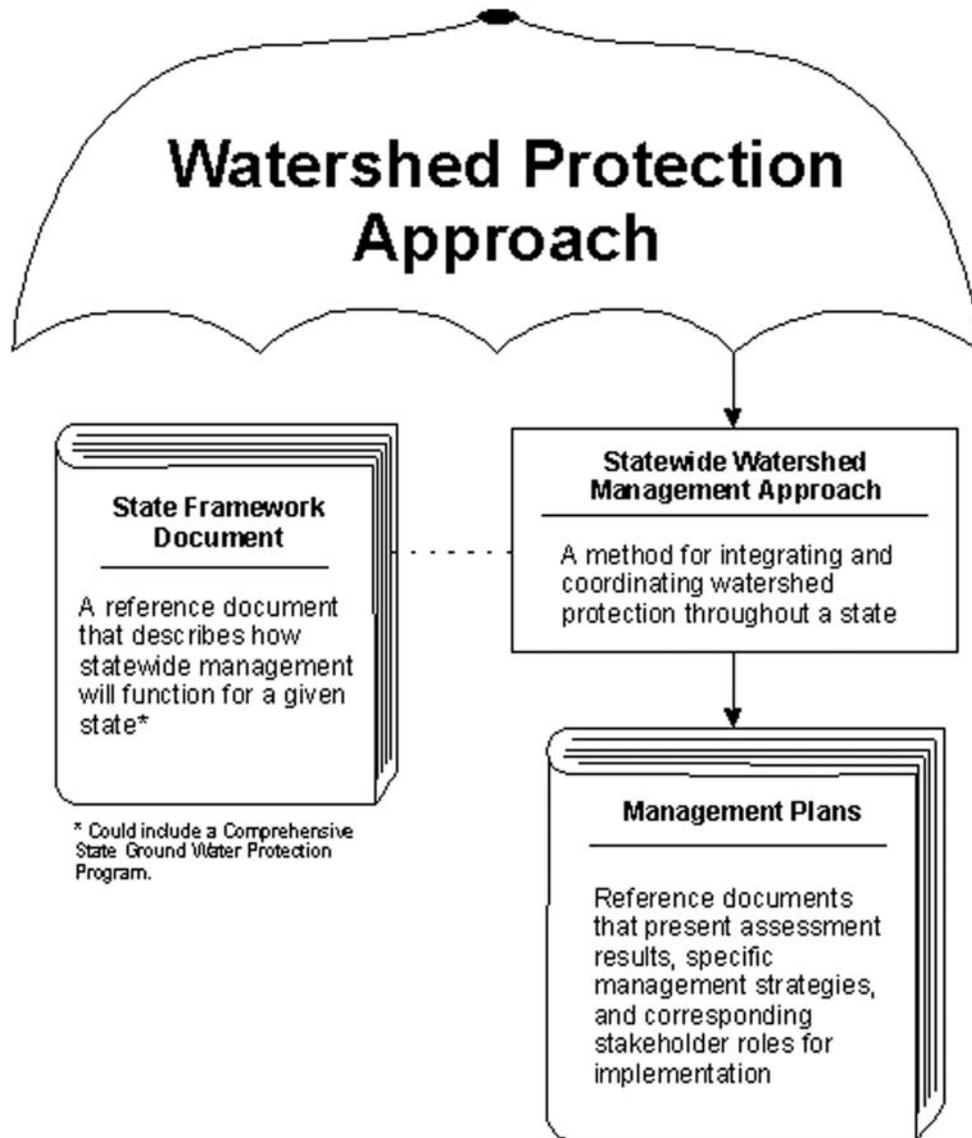


Figure 1-3. Statewide watershed management and key documents resulting from the approach.

1.6 Purpose of This Document and Intended Audience

This guide is about the process of establishing a statewide WPA. It is not technical guidance and does not cover topics such as monitoring or permitting issues in detail. Rather, it presents common themes or elements among states that have adopted or begun the transition to watershed management -- states such as Delaware, Idaho, Nebraska, North Carolina, South Carolina, Texas, and Washington. Chapter 2 describes these common elements. Chapter 3 addresses the benefits of statewide watershed management, and Chapter 4 discusses how a state can begin to implement this approach. Chapter 5 lists references. Additional information about how ground water protection fits into the approach is presented in Appendix A, and Appendix B focuses on Nebraska's basin cycle.

This document is intended for state water resource managers and technical personnel as well as for the natural resource managers in other state, federal, tribal and local agencies with whom they cooperate. By outlining the components of a statewide approach and by providing examples of how some states are currently operating under such an approach, the document encourages the adoption of watershed-based water quality management by other states.

A companion report, *Watershed Protection: A Project Focus* (U.S. EPA, 1995), describes key elements of local-scale watershed projects. Larger watersheds or basins can provide the framework for coordinating multiple watershed projects around the state, for targeting resources, and for operating permit and monitoring programs. At the same time, other water quality and ecosystem protection activities can be managed best at the watershed level. Examples include controlling point and nonpoint source pollutant loadings to a lake or to a stream recharging an aquifer and restoring riparian habitat in the headwaters of a watershed.

Chapter 2: Managing by Watershed: Common Elements

States independently develop watershed approaches to fit their unique circumstances. Several key elements have emerged, however, that are common in the approaches developed by states to date (Figure 2-1):

- Management units
- Management cycles
- Stakeholder involvement
- Strategic monitoring
- Assessment
- Prioritization and targeting
- Development of management strategies
- Management plans
- Implementation of the plans.

These are common elements rather than steps; they do not necessarily occur in a sequence. Stakeholder involvement, for example, is crucial throughout implementation of any watershed approach. The following sections describe each of the common elements in more detail.

2.1 Management Units

Management units are the geographic units within which the state will implement its Watershed Protection Approach. States often select major watersheds or basins as their management units, although aquifers, groups of watersheds, or composites of ground water and surface watersheds are also used.

The U.S. Geological Survey (USGS) has designed and mapped a national system of hydrologic units for cataloging, sometimes called HUCs, that provide a common national framework for delineating watersheds and their boundaries at a number of different geographic scales. The hierarchical system's largest units, called water resources regions, are each designated by a 2-digit code. Each regional unit may be subdivided into 4-digit subregions, and further subdivided into 6-digit and 8-digit units representing smaller and smaller watersheds.

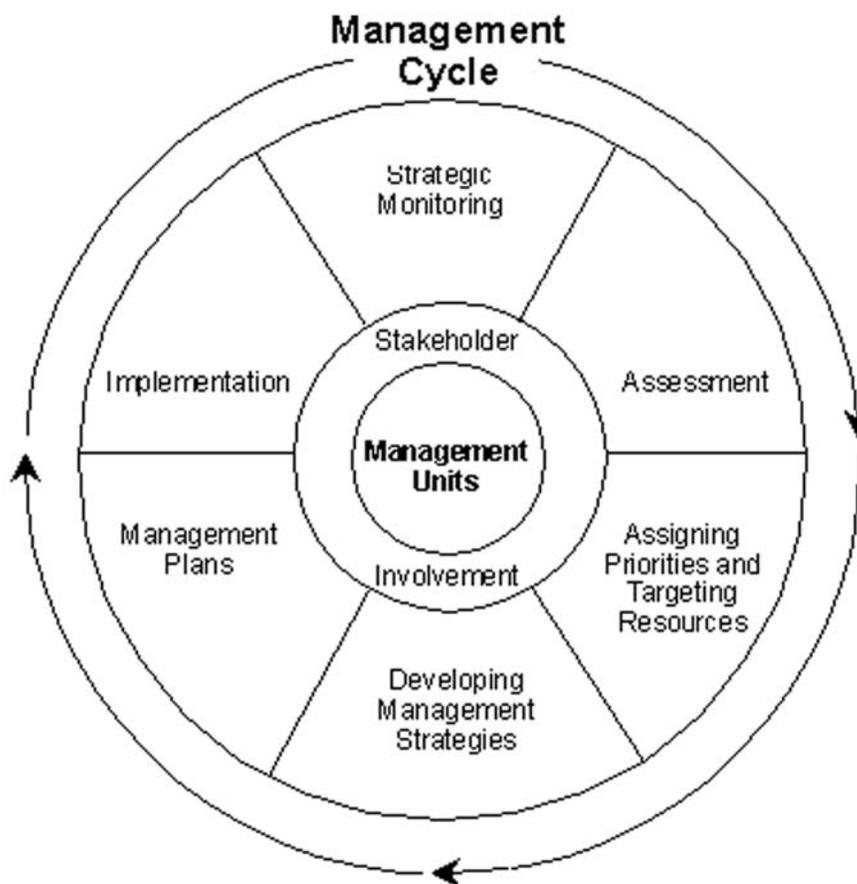


Figure 2-1. Common elements of a statewide watershed management approach

The 8-digit units, which are still fairly large watersheds averaging thousands of square miles each, are the most detailed delineations currently available nationwide as a geographic information system (GIS) coverage or a map. The approach has been carried further in individual states down to the 11-digit and the 14-digit level to delineate watersheds averaging approximately 100 square miles and 30 square miles each, respectively. As hydrologic units will be an important GIS data set within the envisioned National Spatial Data Infrastructure, all watershed programs wishing to delineate smaller-scale watersheds should collaborate with this existing national framework for watershed delineation.

The North Carolina Division of Environmental Management uses river basin boundaries developed in the 1970s under CWA Section 303(e). The state is divided into 17 basins. The South Carolina Bureau of Water Pollution Control took a different approach by combining basins to form five very large basin management units. The highlight on page 2-4 describes water quality management areas used for basin planning by the Washington Department of Ecology. Many states have also delineated smaller watersheds for water quality management. For example, Virginia has delineated approximately 500 watersheds based on NRCS (formerly SCS) delineations; South Carolina and Wisconsin have delineated approximately 270 and 330 watersheds, respectively.

Figure 2-2 shows a "nested" hierarchy of watersheds, including a river basin, USGS Cataloging Units, and NRCS "14-digit watersheds". NRCS has begun a nationwide initiative to delineate 14-digit watersheds for natural resource management. These small watersheds are subsets of both the USGS Cataloging Units and previous SCS-delineated watersheds. North Carolina, for example, has approximately 1,640 14-digit watersheds statewide; they average 30 square miles in size.

The development of fully compatible watershed boundaries typically involves close coordination among USGS, NRCS, and state water quality, coastal management, and GIS agencies, among others. Nested watersheds are important because they offer stakeholders different levels at which to manage water quality. Basins allow the state to allocate resources, while small watersheds are useful for local governments and local NRCS conservation programs. The nested watershed approach also facilitates information exchange among all levels of government, especially if stakeholders are maintaining data in a GIS format.

State of Washington's Water Quality Management Areas

The Washington Department of Ecology has divided the State into 23 water quality management areas. These areas are groupings of several water resource inventory areas (WRIAs) established to respond to the State Water Resources Act of 1971 and as sewage drainage basins to respond to the State Water Pollution Control Act. The criteria used by the Department of Ecology for aggregating the WRIAs into basin planning units are

- Common receiving waters and aquifers, where known
- Complexity of the system and pollution sources
- Staff resources available
- Regional office boundaries
- Water availability and water-short areas
- Water use, including groundwater supply
- Geography
- Areas of population growth (actual and potential)
- Loading from septic systems and sewers
- Ratio of unpermitted to permitted activities
- Water quality condition.



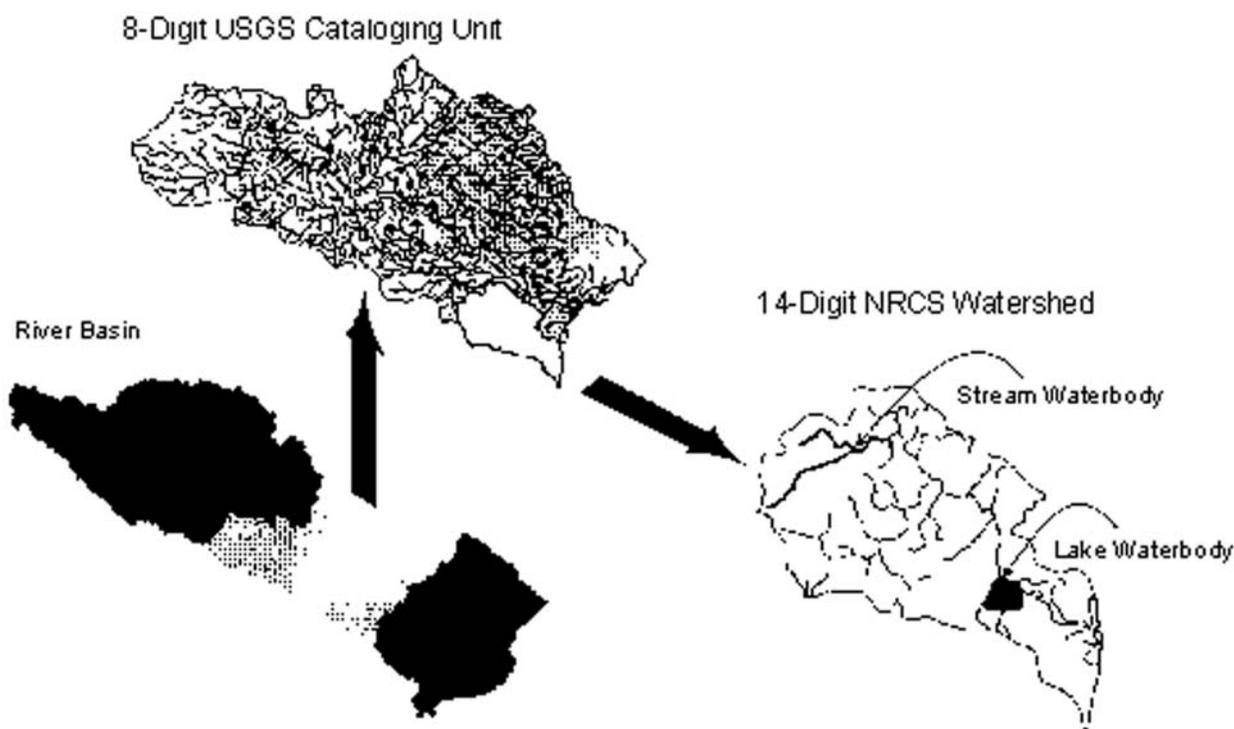


Figure 2-2. Hierarchy of nested watersheds (adapted from GIS coverages for the Upper Tar-Pamlico River Basin, NC; RTI, 1994).

Ecoregions represent another important type of boundary and are useful integrators for managing water quality. Ecoregions are areas having physical and biological traits that tend to support characteristic aquatic communities. Ecoregions do not generally coincide with basins or watersheds, and a given basin may cross more than one ecoregion. However, the two concepts (basin and ecoregion) are fully compatible. For example, basin goals might be based on biological criteria for each ecoregion that crosses the basin.

2.2 Management Cycles

Water quality management activities for each major watershed or basin are completed within a management cycle. A management cycle has three features that create an orderly system for continually focusing and coordinating management activities to meet water quality standards and other environmental goals:

- A specified time period -- Key surface and ground water management activities within a basin (e.g., monitoring, assessment, priority setting, management strategy development, plan preparation, and plan implementation) occur within a specified time period. The length of the cycle is state-specific, but most states are using a 5-year cycle to coincide with NPDES permitting requirements.

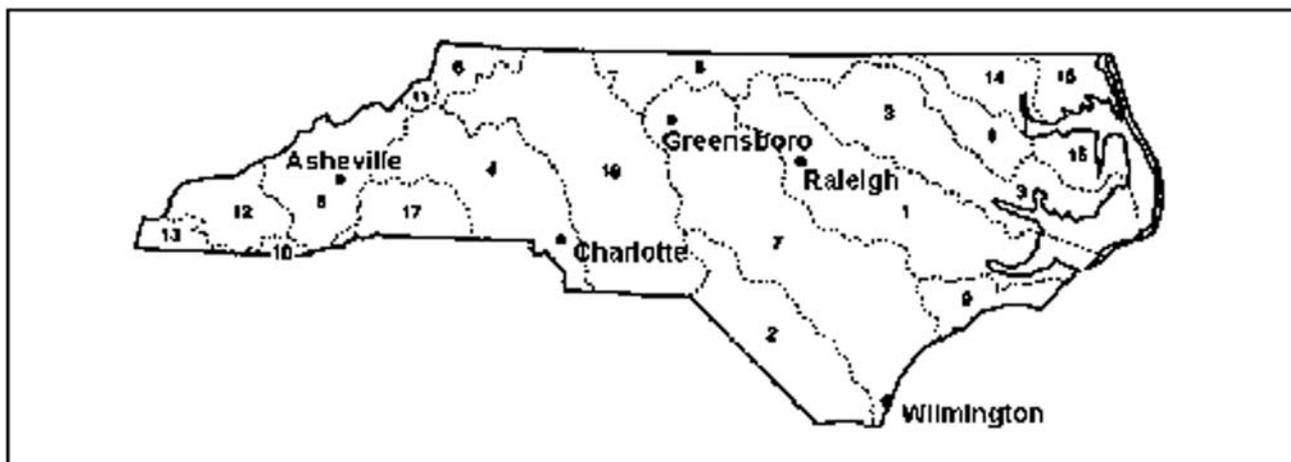
- A sequence for addressing basins -- A sequence is established to balance workload from year to year. States find it impractical and inefficient to perform all management activities in every basin at the same time. Therefore, in one year a state may focus on monitoring in one-fifth of its basins; assessment and priority setting in another one-fifth; modeling and TMDL development in another one-fifth; developing management plans in another one-fifth; and implementing management plans in the remaining one-fifth of the state's basins. In succeeding years of the cycle, efforts rotate among the basin groups. It takes time to work into this cycle, so the state must determine the sequence in which basins will be addressed (see the North Carolina highlight).

In choosing a sequence, most states take into consideration the workload requirements as well as the degree of water quality impairment or environmental risk. Other considerations include data availability and stakeholder support. See the Washington highlight on for a description of the factors that state considered in establishing its sequence.

North Carolina's Basin Cycle

Below is the schedule for all 17 basins within the 5-year planning cycle of North Carolina's basin management approach. This schedule will be repeated every 5 years to provide a long-term management framework that can build on past efforts. North Carolina completed its first round of basin management activities for the Neuse River Basin in 1993 with approval of the basin plan and issuance of NPDES permits. The next cycle of activities for that basin will be completed in April 1998. Activities for all 17 river basins will be completed by November 1998. For an individual basin, the activities within the 5-year planning cycle are as follows:

<u>Activity</u>	<u>Time Frame</u>
Data collection	Years 1-3
Data analysis and modeling	Years 1-4
Basinwide management plan development	Year 4
Review and approval of plan and NPDESS permits	Year 5



NO.	RIVER BASIN	MONTH	YEAR	NO.	RIVER BASIN	MONTH	YEAR	NO.	RIVER BASIN	MONTH	YEAR
1	Neuse	April	1990	7	Cape Fear	January	1996	14	Chowan	January	1996
2	Lumber	November	1994	8	Roanoke	January	1997	15	Pasquotank	January	1996
3	Tar-Pamlico	January	1995	9	White Oak	June		1	Neuse	April	
4	Catawba	April		10	Savannah	August		16	Yaddin	July	
5	French Broad	August		11	Watauga	September		17	Broad	November	
6	New	November		12	Little Tenn.	October		2	Lumber	November	1999
				13	Hinshaw	December					

Basinwide Discharge Permitting Schedule for North Carolina's 17 Major River Basins

Presented above are the month and year in which issuance of discharge permits commences in each of the state's major river basins. Basinwide water quality management plans are to be completed for each basin several months prior to these dates.

North Carolina's Basin Cycle

North Carolina's basin approach includes an emphasis on protection of surface water sources of drinking water. In addition to the 17 major river basins, the Department of Environment, Health, and Natural Resources has identified over 200 smaller watersheds supplying drinking water to communities. These water supply watersheds range in size from 3 to 300 square miles and cover about 23 percent of the state. Local governments are required to develop and implement watershed plans protective of drinking water. These plans address allowable density and types of development in these watersheds or portions of watersheds.

North Carolina's basin approach thus assesses water supply protection needs along with other factors and identifies priorities for further protection throughout the basins. Other factors considered in setting priorities for action include ambient water quality, fish tissue contamination, nonpoint source impacts, NPDES permits, and storm water impacts.

- A schedule for management activities -- Once the statewide sequence is established, a detailed schedule of management activities is developed. The schedule specifies when particular activities will occur during the 5-year cycle, thus providing a long-term reference for all stakeholders. Appendix B contains the detailed schedule for basins in Nebraska; the first 5-year cycle shows how activities will be phased in across the state, and the second 5-year cycle indicates how activities ultimately will be coordinated across the state.

In many states, the management cycle will have to take into account the goals, objectives and activities of a broad range of programs, agencies and public interest groups who may also be stakeholders and basin team participants. For example, Delaware will incorporate other natural resource (e.g., fish and wildlife) and county planning agencies. A management cycle for states that take an integrated resource management approach may have different activities, structure, and timing than those that focus exclusively on water quality. For example, Idaho's Department of Environmental Quality will host workshops to build basin teams from public resource management agencies, interested citizens and tribes. Each team will determine the cycle for its planning basin.

Most of the examples provided in this document focus on programs of state water quality agencies. However, urban planning and zoning (county planning agencies), habitat restoration and species protection plans (fish and wildlife agencies), and soil conservation and animal waste management (agricultural agencies) can all contribute to the preservation and protection of waterbody integrity.

Washington's Basin Cycle

By 1999, the Washington Department of Ecology will be planning, collecting data, analyzing data, managing information, and issuing permits for at least four basin management units per year. Baseline program activities such as enforcement and compliance will continue on a statewide basis. The Department used the following factors to establish the schedule of activities in each basin management unit:

- Number of dischargers and permit workload
- CWA Section 303(d)-listed waters
- Completed TMDLs
- Availability of ambient monitoring data
- Threats to beneficial uses (e.g., population growth)
- Likelihood of stakeholder support
- Historical water quality initiatives (e.g., NPS projects)
- Existing and potential funding including grants
- Workload balance.

2.3 Stakeholder Involvement

A watershed approach creates opportunities for a broad range of stakeholders to play meaningful roles in basin plan development and implementation. Success depends on the pooled resources, energy, and regulatory authority of multiple stakeholders. Stakeholders are all agencies, organizations and individuals that could be affected by water quality management decisions. They may include:

- The state water quality agency
- State agriculture, forestry, and wildlife agencies
- State public health agencies
- Municipal and industrial dischargers
- City and county governments
- Trade associations
- Environmental groups
- Chambers of Commerce
- Local offices of Federal agencies
- EPA Regions.

Special Stakeholders in Delaware, Idaho, and Texas

In Delaware, basin management teams include county planning authorities. Their participation allows the Department of Natural Resources and Environmental Control to more effectively deal with land use issues that impact physical habitat and to better coordinate their local management activities.

The Idaho Department of Environmental Quality and U.S. EPA Region 10 are jointly developing a basin approach for Idaho. Much of Idaho's land is federally owned and managed by resource agencies such as the Bureau of Land Management and the Forest Service. A key objective for Idaho is to engage these resource agencies directly in the process.

The Texas Natural Resource Conservation Commission is incorporating their Water Utilities and Water Resources (water rights) Programs into their basin framework. These types of stakeholders, often neglected by traditional water quality programs, add valuable insight and experience. For example, the Water Utilities Program has established goals to reduce pollutant loading to protect drinking water supplies that are consistent with water quality agency goals. The Water Resources Program brings issues such as the timing and level of diversions into the basin management arena.

Stakeholder roles and responsibilities should be defined for each stage of the management cycle. These roles and responsibilities can include:

- Data and research sharing
- Joint monitoring
- Identification of waterbody stressors
- Priority setting
- Public meetings for goal setting
- Public outreach events such as presentations or festivals
- Reviewing management plans
- Shared commitment of resources for plan implementation.

The highlight above describes efforts by three states to include key stakeholders. The companion volume to this document, *Watershed Protection: A Project Focus* (U.S. EPA, 1995), also contains examples of stakeholder involvement.

2.4 Strategic Monitoring

Most types of monitoring are strategically coordinated by basin to address various needs such as:

- Identifying stressors and their sources
- Determining water quality status and trends
- Targeting priority waterbodies/watersheds for action

- Evaluating the effectiveness of management actions
- Developing models to support TMDL development and permit issuance.

States that implement watershed approaches generally modify their existing monitoring networks to improve cost efficiency by focusing on one or a few basins at a time rather than the entire state. Monitoring programs often feature:

- Maintenance of a statewide fixed-station ambient network for physical/chemical parameters, monitored monthly or quarterly; may have fewer sites than previously.
- A network of "rotating basin" monitoring sites sampled only 1 or 2 years out of the basin cycle; some new sites may be selected each cycle to address watershed-specific concerns and to measure the effectiveness of controls
- Increased biological monitoring tailored to the ecoregion(s) or subregions and their reference conditions
- An increased number of intensive surveys for model development (e.g., for TMDLs)
- A return to each basin at regular intervals (e.g., 5 years) to conduct intensive surveys and rotating monitoring. Continuous enforcement activity; compliance monitoring of wastewater treatment facilities may remain independent of the rotation cycle or may focus on specific basins in a given year.

Features of basin-oriented monitoring in Washington and South Carolina are described in the highlight.

2.5 Assessment

Assessment is the process of determining levels of water quality and ecosystem impairment and identifying sources and causes of this impairment. States have been assessing water quality for many years under CWA Section 305(b). Assessment typically involves comparing monitoring data to state water quality standards to determine whether each waterbody's designated uses (e.g., aquatic life, swimming, drinking) are being achieved. Statistical analyses also may be done to determine whether water quality is improving or declining over time. Thus, assessments are important because they provide the basis for evaluating the success of past management actions and targeting future management efforts.

Two States' Approaches to Monitoring

The Washington Department of Ecology has revised its monitoring activities. "Core" fixed stations throughout the state are sampled monthly every year of the 5-year cycle for basic physical and chemical parameters; targeted watershed stations are sampled monthly for 1 year in a 5-year cycle; biological samples (e.g., benthic macroinvertebrates, phytoplankton, fish) are collected mid-summer in year 3; and lakes are sampled twice annually, near the start and end of the growing season. Compliance monitoring occurs in years two or three in the cycle for a given watershed. Intensive surveys are initiated in year two and are completed in years three or four.

The South Carolina Bureau of Water Pollution Control has also revised its monitoring program.

The Bureau will continue its statewide primary network of over 200 sites on major rivers and estuaries. However, its secondary network now focuses almost entirely on watersheds in one basin per year, with emphasis on

- Waterbodies listed under CWA Sections 303(d), 304(l), and 314
- Watersheds with limited water quality data
- Known point source and NPS problem areas
- Waterbodies impacted by groundwater
- Waterbodies needing wasteload allocations.

In recent years, state 305(b) assessments have focused on biological measures of ecosystem integrity in addition to chemical measures. For example, biological assessments of streams may include measures of fish and benthic macroinvertebrate assemblages and habitat quality. This focus on aquatic ecosystem integrity is consistent with watershed protection approaches and, in fact, a state may choose to set the water quality goals for a basin or its watersheds in terms of biological integrity. If a state has developed biological criteria, these can be used to develop water quality goals for individual basins. One basin may have a set of biocriteria for each ecoregion that crosses basin boundaries.

States incorporate assessment results into their management plans. This information also appears in state Section 305(b) reports, but its presence in basin plans makes the assessments more accessible to stakeholders. In later cycles, assessments help determine whether basin and watershed goals are being achieved by the management options chosen in an earlier cycle.

2.6 Assigning Priorities and Targeting Resources

As discussed in Section 2.2, states often develop their sequences based on factors such as workload considerations, data availability, and waterbodies needing TMDLs. Once the sequence is established, the state sets priorities for water quality protection and restoration needs within each watershed as the watershed arises in the management cycle.

Prioritization and targeting may be thought of as two separate steps. *Prioritization* is the process of ranking water quality concerns. *Targeting* is the process of deciding how resources should be allocated to address priority concerns. For example, waterbodies in a basin may be prioritized or ranked according to such factors as

- Severity of risk to human health and the aquatic community
- Impairment to the waterbody (documented or potential)
- Resource value of the waterbody to the public.

The targeting step may involve selection of specific watersheds or waterbodies for special management attention (e.g., as local watershed projects), based on

- Ranking from the prioritization step above

- Availability of staff and financial resources
- Overall planning goals (e.g., statewide or basinwide goals)
- Willingness to proceed on the part of local stakeholders.

Targeting allows states to use limited resources to address priority ecosystem concerns. New priority watersheds or waterbodies may be selected during each management cycle.

Prioritization and targeting of watersheds and waterbodies are described further in *Geographic Targeting: Selected State Examples* (U.S. EPA, 1993b). A method developed by the State of Oklahoma is described in the highlight on the next page.

A Watershed Targeting Approach

In the late 1980s, the Oklahoma Conservation Commission delineated approximately 300 watersheds for NPS assessment. The agency used a numeric index method for ranking these watersheds based on waterbody-level information. For each watershed with adequate data, three factors were calculated:

- *Beneficial Use Factor*: Each assessed waterbody received a score according to degree of use support from the EPA Waterbody System database. Scores range from low (1) for a fully supporting waterbody to high (4) for a nonsupporting waterbody. Weights were assigned based on waterbody size.
- *Human Use Factor*: Highly populated watersheds and those containing major recreational attractions received higher scores (e.g., 4 on a scale from 1 to 4).
- *High-Quality/Nondegradation Factor*: This factor was scored according to ecological value of assessed waterbodies. Scores range from low (1) for habitat-limited fisheries to high (4) for outstanding resource waters. Scores were weighted by waterbody size.

For more detailed information on this and other state indexes, see *Geographic Targeting: Selected State Examples* (U.S. EPA, 1993b).

2.7 Developing Management Strategies

Before preparing a basin plan, the state identifies a range of management strategies and evaluates their effectiveness. Management strategies take into consideration the unique problems of individual watersheds as well as constraining factors such as resources available for control measures, legal authority, willingness of stakeholders to proceed, and the likelihood of success.

The first step in developing management strategies is to establish clear goals and objectives for addressing priority concerns. Goals and objectives can be quite specific. For example, a basin goal could be to reduce or eliminate the incidence of algal blooms in an estuary; a corresponding objective could be to reduce total phosphorus concentrations in its tributaries by 30 percent. The Klamath River Basin highlight describes one goal and one objective that provide a basis for management strategy development for that basin. Similarly, goals and objectives may be developed for certain watersheds. See *Watershed Protection: A Project Focus* (U.S. EPA, 1995) for further discussion of watershed goals.

Goals and Objectives of the Klamath River Basin Restoration Program

The Klamath River Basin was once one of the most productive anadromous fish spawning areas on the West Coast. Physical barriers, habitat destruction, and pollutant loads have severely damaged this important commercial and Tribal fishery. The long-range plan of the Klamath Restoration Program uses a "step-down" approach with specific goals, objectives, and policies or project priorities. Following is an example of one goal and a single objective under this goal.

Goal I: Restore, by 2006, the biological productivity of the basin in order to provide for viable commercial and recreational ocean fisheries and in-river Tribal (subsistence, ceremonial, and commercial) and recreational fisheries.

Objective 1: Protect stream and riparian habitat from potential damage caused by timber harvesting and related activities.

- Improve timber harvesting practices through local workshops; develop habitat protection and management standards for agency endorsement; create a fish habitat database; view existing regulations as minimum expectations
- Contribute to evaluating the effectiveness of current timber harvest practices through: developing an index of habitat integrity; incorporating fish habitat and population data into state water quality assessments; monitoring recovery of habitat in logged watersheds
- Promote necessary changes in regulations--State Forestry Practice Rules; Forest Service Policies in Land Management Plans, BMPs
- Anticipate potential problems by requesting additional state monitoring programs and by modifying State Forest Practice Rules and Forest Service plans to protect highly erodible soils and give priority to protection of unimpaired salmonid habitat.

Source: Klamath River Basin Restoration Program, 1991

Nutrient Trading in the Tar-Pamlico Basin

The Tar-Pamlico Basin is designated as Nutrient Sensitive Waters (NSW) by the state of North Carolina. In 1989, state officials were poised to establish strict new controls on point sources of phosphorus and nitrogen, believing at the time that point source controls were the only enforceable option. However, dischargers concerned about the high capital costs of the new controls formed the Tar-Pamlico Basin Association and worked with the state and two local environmental agencies to craft a nutrient trading program.

The management strategy for the basin now calls for the Association to fund rural best management practices (BMPs) by contributing to the State Agricultural Cost Share Program. The investment by the Association was approximately one-fifth the amount that point source controls were expected to cost, and the reduction in loading to the nutrient-sensitive portion of the basin should be considerably larger than point source controls alone could achieve.

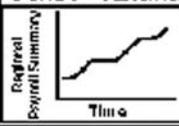
Some strategies developed for a management plan may be basinwide in nature (e.g., phosphate detergent bans or incentives for riparian protection) while others may be more local (e.g., improved animal waste management in a watershed with a high concentration of livestock operations). Implementation of a basin approach allows states to address large-scale problems and local issues at the same time (see the "Nutrient Trading" highlight above).

Stakeholder involvement contributes to equity in point and nonpoint sources controls. Individuals are more likely to negotiate when their knowledge of watershed problems is strong and they see that all sources are being asked to make sacrifices. Figure 2-3 illustrates a method for relating specific goals and objectives to stakeholders for management strategy development. Effective statewide approaches may provide opportunities for innovative management alternatives such as pollutant trading, wetlands mitigation banking, and ecological restoration. (See Section 3.10 for additional information on these topics.)

2.8 Management plans

Management plans are critical. They document the process, the selected management strategies, and stakeholder roles, and also serve as a reference for future basin cycles. Teams, composed of staff of the state water quality, agricultural, public health and other state agencies, are responsible for developing the documents. Plans are updated periodically thereafter.

Figure 2-3. Watershed management goals, objectives, and stakeholder matrix (adapted from Anacosta Restoration Team)

		Participating Programs, Agencies, and Other Stakeholders						
GOAL 1 - Control of Pollutant Inputs								
	Stormwater - Sewage Overflow Control NPDES Permits Point/Non-Point Trading Program NPS BMPs							
GOAL 2 - Ecological Restoration								
	Channel Reconstruction Water Flows Redesign Diversion Structures							
GOAL 3 - Habitat Preservation								
	Wetland/Forests Conservation Easement Program Wetlands Watershed Scale Advances Identification							
GOAL 4 - Public Health/Drinking Water								
	Public Water Supplies Comprehensive Groundwater Protection Policy Wellhead Protection Source Water Protection							
GOAL 5 - Biodiversity/Biological Integrity								
	Improve Timing for Diversions Contiguous Habitat Corridors Species Landscape Needs Analysis							
GOAL 6 - Sustainable Economic Development								
	Plan for Growth Eliminate Excessive Soil Loss							
GOAL 7 - Stewardship								
	Public Outreach and Education							

Watershed management plans must specify how goals will be achieved, who is responsible for implementation, on what schedule, and how the effectiveness of the plan will be assessed. Clearly defining an implementation step is a characteristic that separates basin protocols from initiatives for planning purposes only. Experience suggests that formal commitments from all stakeholders are critical before moving into implementation.

The upcoming highlight shows a draft basin plan outline for the Delaware Department of Natural Resources and Environmental Control.

2.9 Implementation

Upon completion and approval of a basin plan, the plan is implemented. Implementation activities may include issuance of NPDES permits with conditions reflecting the plan provisions, implementation of voluntary or mandatory BMPs to control NPS pollutants, critical area protection, habitat restoration, a monitoring program to measure success and guide future plan revisions, and development of TMDLs.

As an example, the *Neuse River Basinwide Water Quality Management Plan* (NCDEM, 1993) describes management strategies for this basin and its watersheds. For the first cycle, the Plan describes point source controls in the Neuse Basin in considerable detail. NPS strategies for this cycle involve numerous existing programs and prioritization of BMP funding. In future cycles, North Carolina anticipates including more detailed information about NPSs and strategies.

Figure 2-4 shows the major steps identified by the Washington Department of Ecology for its statewide approach. Although the terminology differs slightly, Figure 2-4 features all of the common elements presented in this chapter.

Basin Management Plans in Delaware

Following is a draft outline for upcoming basin plans, as developed by the Delaware Department of Natural Resources and Environmental Control.

1. Introduction/Summary
 - 1.1 Purpose of Plan
 - 1.2 Whole Basin Planning Cycle
 - 1.3 Participating Agencies and Publics
 - 1.4 Summary of the Management Plan
2. General Basin Description
 - 2.1 Physical, Geographical, and Ecological Features
 - 2.2 Overview of Potential Environmental Stressors
 - 2.3 Land-Use/Land Cover Characteristics
 - 2.4 Socioeconomics and Government
 - 2.5 Projected Trends in Basin Development

3. Existing Environmental Conditions, Uses, and Stresses

3.1 Land

3.2 Water

3.3 Air

3.4 Resource Integration

4. Major Concerns and Priority Issues

4.1 Issues of Concern

4.2 Targeted Geographic Areas

5. Long Term Goals and Management Strategy

5.1 Goals

5.2 Options Analyzed

5.3 Strategies Selected

5.4 Measures of Success

6. Implementation

Area-Specific Implementation Activities

7. Next Steps

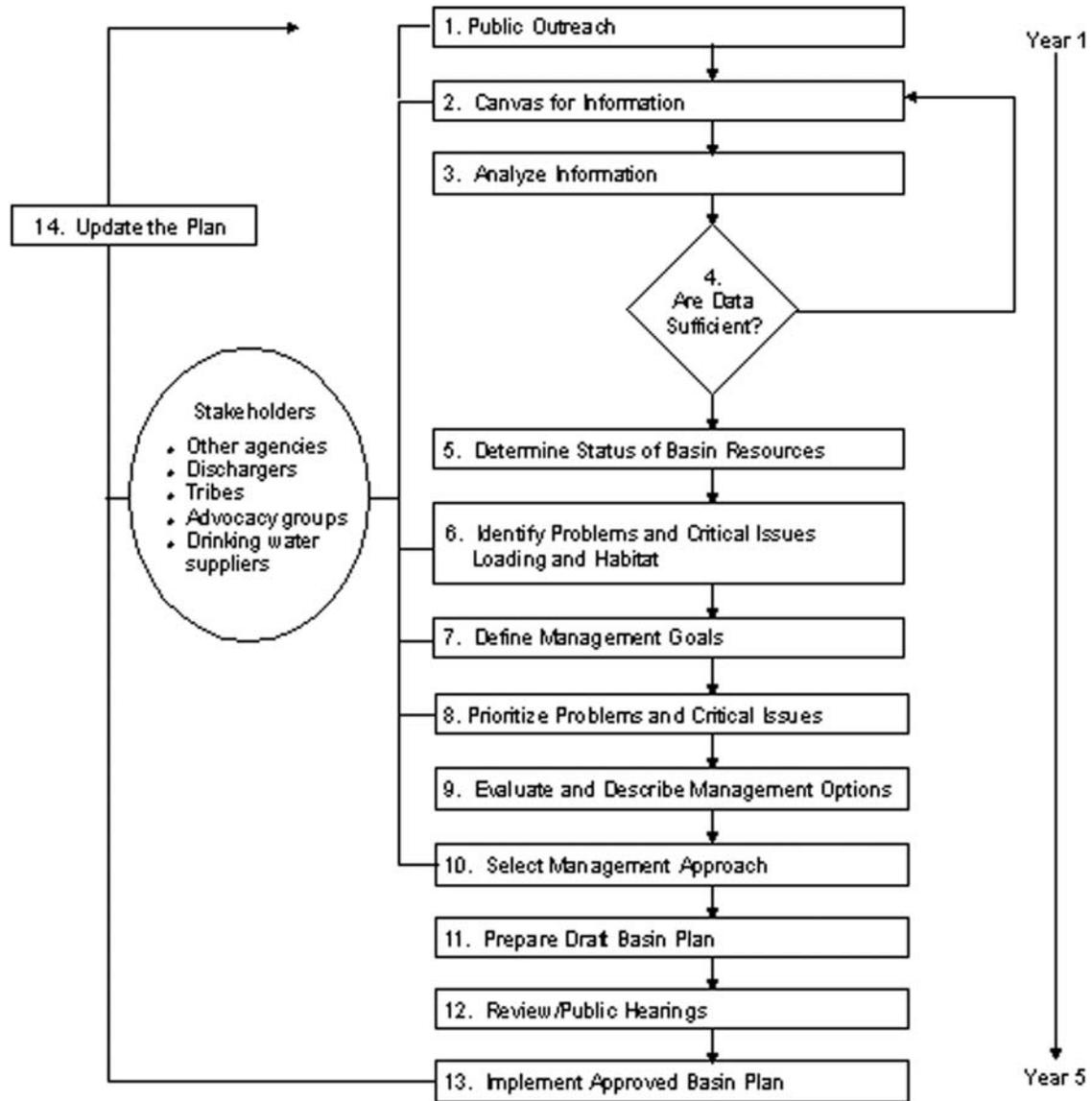


Figure 2-4. Major steps in developing and implementing Basin Water Quality Management Plans (adapted from Washington Department of Ecology)

Chapter 3: Why Manage by Watersheds?

Adopting a watershed approach statewide is an initiative taken by a state water quality agency in consultation with other stakeholders, usually in response to a self-assessment of that state's programs. This chapter discusses why states have adopted statewide watershed management. Most of this discussion concerns states' *expectations* of outcomes based on extensive workshops and planning; it may take several years for these benefits to be achieved and measurable, and state approaches may be revised over time. In some cases, however, states are already benefiting from adopting a watershed-oriented approach, e.g., through improved staff morale or increased miles of streams monitored each year.

In presenting the following expected benefits, EPA does not mean to imply that this is a simple process. It requires time, energy and perseverance, and presents several challenges, as discussed in Chapter 4.

3.1 Water Quality Programs Can Focus More Directly on the Resource

Historically, EPA and state regulatory agencies have organized their water programs around discrete activities such as permitting, monitoring, enforcement and nonpoint source control. As a result, program success tends to be measured in terms of program activities - numbers of permits, compliance orders, inspections, or samples, for example. These activities often do not demonstrate or measure improvements in water quality. Focusing on the entire basin, on the other hand, requires staff in different programs to ensure that their work is consistent with basinwide goals. In other words, the focus on environmental results is sharpened.

3.2 The Basis for Management Decisions is Improved

Organizing around major watersheds or basins can improve the scientific basis for management decision-making in three ways:

- Focusing on basins and watersheds encourages agencies to seek information on all significant stressors, including those that tend to be overlooked by traditional programs (e.g., ecosystem effects due to habitat loss). This encourages monitoring programs to account for the full realm of impacts and sources.
- The pooling of resources and data by multiple stakeholders tends to increase the amount and types of data available for carrying out assessments and prioritizing problems for action.
- Basin-oriented monitoring may result in more detailed information. In North Carolina, for example, approximately 38 percent more monitoring sites were sampled during the first full year than previously, with about the same level of effort.

3.3 Program Efficiency Is Enhanced

Focusing on individual basins can improve program efficiency within the State water quality agency. For example:

- Coordinating monitoring by basin results in more efficient use of staff and reduces travel time between sites.
- Modeling studies can be consolidated to increase the stream miles of waterbody modeled per unit of effort.
- NPDES permit notices can be consolidated by basin to limit the number of publication documents; this requires adjusting permit expiration schedules so that all permits in a basin have the same expiration dates.
- Public meetings can be consolidated to cover multiple permits for a given basin.

The development of basin plans can also be a means to achieve compliance with CWA mandates:

- Basinwide assessment results can support Section 305(b) reporting if a common database is used for basin plans and Section 305(b) reports. For example, basin plans can include water quality assessment text and Waterbody System data summarized by basin. The Waterbody System can then be used to generate the required statewide summary results and tables for Section 305(b) reports. In 305(b) reports, states may choose to reference the basin plans for detailed assessment results, thus avoiding duplication of effort.
- Basin plans can satisfy Section 303(d) reporting requirements since strategies for addressing impaired waters (i.e., actual TMDLs) can be included in basin plans.
- TMDL development often requires a watershed approach. EPA regulations and guidance define a TMDL for a specific pollutant as being equivalent to the loading capacity of a waterbody. This total load includes both point and nonpoint sources. Since nonpoint sources are often diverse and widely distributed across a waterbody's watershed, management strategies that affect the entire watershed are often needed.

3.4 Coordination Among Agencies in the State Can Be Improved

A watershed approach can help clarify the role of the state water quality agency in relation to other natural resource agencies -- those in state and local government as well as federal agencies, such as USGS and USDA, which have state and local offices. Some tasks require site-specific knowledge and close local contact; other tasks need state-level authority or can be more cost-effective at that scale. For instance, the state water quality agency is usually best equipped to conduct laboratory analysis and monitoring and to provide oversight for water quality standards

and discharge permitting. This agency can play a coordinating role to secure support from other state and federal agencies and leverage resources for multi-stakeholder efforts.

The watershed approach provides an umbrella under which local programs can be reinforced and their consistency with state- and basin-level objectives ensured. Local agencies and organizations may be in the best position to develop detailed land use inventories, organize workshops and educational programs, and implement BMPs, habitat restoration and protection, or land use controls.

Improved efficiency may also result from closer coordination among programs. For example, Nebraska's Department of Environmental Quality hopes to reduce the amount of time spent investigating citizen complaints. Through closer coordination, only one agency will respond to each complaint and that agency will determine if further action is needed. In Alabama, many water-related programs are being coordinated through the CSGWPP (see highlight).

3.5 Resources Are Better Directed to Priority Issues

A state is better able to focus its water quality program resources, which are often dispersed among several agencies, on those portions of basins where they will do the most good.

Alabama's Use of Its Comprehensive State Ground Water Protection Program to Coordinate Its Programs

As a first step toward total water resource management, Alabama is coordinating its programs through its Comprehensive State Ground Water Protection Program (CSGWPP). In developing its CSGWPP, the state recognized the unique challenges of ground water protection, including the enormous costs and technical difficulties of ground water remediation, and the difficulty of locating sources of contamination due to the lag time between discharge of pollutants at the land surface and their transport through an aquifer. These challenges emphasize the need for a coordinated state approach centering on common priorities.

Alabama is implementing this coordinated prevention approach through its CSGWPP. All of Alabama's major environmental programs, including its waste programs, are located in the Alabama Department of Environmental Management. In addition, Alabama has established the Water Programs Advisory Committee, which brings together all the major entities with ground water protection responsibilities. Alabama's Department of Agriculture has been a full partner in this effort. Once the CSGWPP has been fully implemented, all ground water-based programs will direct their efforts first at wellhead protection areas. Alabama is also in the process of developing a ground water classification system that will direct program priorities. Currently, the state's Underground Storage Tanks Program is focusing its inspection and prevention efforts in wellhead areas and is spending funds to help delineate the state's wellhead areas.

The watershed approach opens the door to statewide application of risk-based procedures for targeting where and how program resources should be spent. This improved capability is primarily the result of three features of a statewide approach:

- Improved information bases and assessments more clearly identify water quality issues and waterbody concerns for the process of assigning priorities.
- Systematic review of all basins as the state cycles through the sequence allows for comprehensive review of within-basin needs as well as comparison of resource needs among basins.
- Improved coordination among stakeholders produces common management priorities and promotes the leveraging of resources.

3.6 Coordination with EPA Can Be Improved

EPA and the states are already working together on programs with a watershed orientation and extensive stakeholder involvement. Examples of such programs include:

- Chesapeake Bay Program
- Clean Lakes Program
- National Estuary Program
- TMDLs with watershed-wide nonpoint source issues
- Great Lakes Program (especially Remedial Action Plans and Lake Management Plans).

Watershed approaches provide an opportunity for EPA and state agencies to augment one another's efforts *throughout* the state, not just in areas that fall under special programs. In the long run, an approach that serves to clarify roles, identify resource needs, and establish management priorities enhances the efforts of all partners.

States pursuing watershed approaches have identified several ways that EPA can help facilitate the approach. EPA can:

- Issue program guidance that encourages long-term watershed management goals rather than short-term program goals that might draw resources away from the basin planning process
- Negotiate annual or multi-year state program plan commitments that revise traditional reporting requirements (e.g., STARS/SPMS, TMDLs, lists, reports)
- Provide for transfer of information so states can learn from experiences throughout the EPA Region or the Nation

- Make basin planning efforts a priority under grant programs such as the Sections 104(b)(3) and 319 programs
- Where feasible, Regions can work with states to ensure that grants have compatible requirements and planning periods
- Assist in negotiations involving other federal agencies or adjoining states.

Regional Flexibility to Accommodate the Transition

North Carolina officials found that considerable time was needed to plan the state's basin approach. Also, the first round of basin plans are more time consuming than plans will be in subsequent 5-year cycles. The state asked EPA Region 4 for permission to maintain existing effluent limits in cases where NPDES permits came up for renewal ahead of the basin schedule (i.e., prior to the year when all the basin's permits are to be renewed). If approved, state staff would not need to remodel each water quality-limited parameter, and permittees would not be penalized by different effluent limits upon the adoption of a basin plan in 1 or 2 years. The state reasoned that major management decisions should await the improved technical analyses associated with the basin plan. Region 4 agreed that this interim flexibility would further long-range water quality management goals.

3.7 Consistency and Continuity Are Encouraged

By focusing on goals to be achieved over several cycles, the approach reduces the tendency to operate in a reactive or crisis mode. Stakeholders can expect improved continuity in decisions because management actions throughout the basin are fixed for at least the length of a basin cycle. Utilities directors, for example, can better plan their long-term wastewater or water supply needs.

Improved *consistency* is possible because pollution sources across a watershed are evaluated within the same time frame, and because management actions are subject to broad scrutiny during the planning process. Thus, for example, animal producers across a watershed are likely to be subject to consistent impact analysis and management measures. Similarly, all NPDES permittees along a major river may be studied at the same time using the same water quality model; the fact that these stakeholders will be aware of the process and each others' discharge limits tends to promote consistent and equitable permits and may reduce the number of grievances filed by permittees.

3.8 Opportunities for Data Sharing Are Enhanced

Increased data sharing is an important benefit of any process in which stakeholders from different organizations work toward common goals. Most state and local agencies have records and information systems unique to their individual functions. In many states, for example, NPS related data are housed in several agencies and are not readily accessible to outside parties.

Inaccessible data on land use and BMPs presents a significant limitation to some states' NPS efforts (see highlight on this page).

Sharing and linking new computer technologies among different agencies is also encouraged. Geographic Information Systems (GISs) can help analyze spatial data for entire basins using data from several agencies, e.g., to show the relationship between land use and predicted nonpoint source loading. GIS buffering techniques are being used to assess the needs for riparian habitat protection, to design greenway systems, for biodiversity analysis, and for planning wetland banking programs, among other purposes.

3.9 Public Involvement is Enhanced

Watershed protection focuses on a discrete resource around which citizens can rally. The approach promotes awareness of water-related issues by citizens and encourages agencies to respond to their concerns. Opportunities for this interaction occur during basin plan development and activities such as workshops, hearings, and citizen monitoring. An additional benefit of public involvement is that a better informed public can lead to increased citizen and legislative support for water quality programs.

Data Sharing in North Carolina

During its first 5-year basin management cycle, North Carolina is promoting data sharing among natural resource agencies. This initiative might have occurred without a basin approach, but the basin approach has accelerated the process. Initially, a Sub-basin Database was developed containing available data on point sources, land use, agriculture, and other NPSs by watershed for preparing basin plans.

Realizing the need for more detailed nonpoint source data, the state is consolidating NPS and BMP data from multiple agencies, including new information yet to be collected. The Tar-Pamlico Basin will be the focus for system development, and the needs of state and local users and modelers will receive top priority. To the extent possible, spatially based information will be collected for GIS analysis. The agencies' GIS data layers are maintained in the state's Center for Geographic Information and Analysis.

3.10 Innovative Solutions Are Encouraged

Some watershed problems, such as habitat destruction, inadequate stream flow, wetlands loss, atmospheric deposition, and introduced aquatic species, are difficult for traditional water quality programs to address. This approach can provide a strong framework for identifying and solving such problems. Problem identification is made easier by involving technical experts from many fields during the environmental assessment portion of the basin cycle - aquatic biologists working side by side with water resource engineers and agricultural specialists, for example, can share data and perspectives on a basin's stressors. Solutions are not limited by the authority or expertise of a single agency, but rather encompass the range of stakeholders. Following are several nontraditional solutions that are feasible under a watershed approach.

Ecological Restoration - Ecological restoration is the reestablishment of physical, chemical and biological components of an aquatic ecosystem that have been compromised by point and nonpoint sources of pollution, habitat degradation, hydromodification, or other stressors (*Restoration as a Water Resource Management Tool*, U.S. EPA 1994b). Categories of restoration techniques include:

- Techniques applied directly to the stream channel (e.g., channel reconfiguration to restore geometry and sinuosity; streambank stabilization)
- Techniques applied in the riparian zone (e.g., replanting of riparian buffers to increase the canopy and other functions)
- Techniques applied outside the riparian zone that result in instream improvements (e.g., BMPs that reduce stormwater surges and improve riverine habitat).

Restoration activities in the stream channel and riparian buffer zone are much less commonly used than traditional point and nonpoint source controls. Yet, restoration activities may be essential for achieving ecological integrity. Examples include:

- Chronic sedimentation and catastrophic blowouts caused by logging roads; such occurrences may be unavoidable on steep terrain, despite engineered BMPs. Revegetation and road decommissioning may be necessary to restore instream habitat.

Providing Fish Passage

On regulated river systems, impassable barriers sometimes block the migrations of anadromous fishes. The most dramatic cases involve salmon stocks on the Columbia River system in the Pacific Northwest, where dams either interfere with fish passage or, in the case of structures like the Grand Coulee Dam, preclude migration altogether. Other obstructions may be less obvious but equally deleterious. For instance, culverts and minor flood control structures around bridges or stretches of a channelized stream can block the migrations of shad or rock fish. Eliminating such minor blockages is a major goal of the Anacostia River Restoration Project in Maryland and the District of Columbia. On larger systems, retrofitting fish ladders or elevators may be viable options.

- Barriers to fish passage that may prevent reestablishment of important fish species, regardless of water quality (see the highlight above).
- Waterbodies with toxics-laden sediments that must be removed before healthy aquatic communities can reestablish themselves.

In many cases ecological restoration may be the most cost-effective way to achieve watershed water quality goals. The highlight on page 3-10 describes a case in which habitat restoration was preferable to advanced wastewater treatment.

Protection of Critical Areas - The National Research Council recently cited promising examples of restoration projects that have restored functions in small wetlands, stretches of streams, and small lakes (National Research Council, 1992). However, the study did not find cases where populations of fish or wildlife were restored on a broad, regional scale.

Fortunately, long-term biological integrity in a watershed may be possible through a watershed-wide strategy of *protecting and restoring* high priority areas such as headwaters, riparian buffers, and biotic refuges.

Traditional CWA programs may not protect these areas. In many watersheds, for example, headwaters and riparian buffers do not receive protection as wetlands under CWA Section 404. The loss of these areas may reduce or eliminate future opportunities for healthy, balanced biological communities and good habitat. In other words, an "ounce of prevention" by protecting key areas in a watershed may be the only way to ensure long-term ecological integrity and avoid the costs of restoration in the future.

Ecological Restoration as a Cost-Effective Solution

In addition to meeting the needs of living resources, ecological restoration or habitat protection can sometimes increase the capacity of a system to assimilate and transform pollutants. In Boulder Creek and the South Platte River in Colorado, city governments rebuilt natural flood plain meanders and reestablished natural channel depths and near-stream vegetation patterns. These restoration efforts helped reduce the concentrations of un-ionized ammonia in reaches downstream of the cities of Boulder and Denver. This in turn eliminated the need for costly sewage treatment plant upgrades.

Biotic refuges are areas with relatively undisturbed habitat that maintain aquatic biodiversity. They may include the headwaters portion of a watershed or undisturbed riverine segments. A watershed may also contain many smaller patches of intact aquatic habitat (e.g., undisturbed small lakes or stretches of stream with deep pools for fish habitat). These biotic refuges and smaller patches may have been protected by fortuitous land ownerships or simple chance. Scientists now recognize that the restoration of ecological integrity across a watershed or a basin may depend on identifying these special areas and protecting them from disturbance (development pressures and point or nonpoint sources).

For further information on protection and restoration of ecologically important areas, see U.S. EPA (1994b), National Resource Council (1992), Doppelt et al. (1993), and Moyle (1992).

Wetlands Mitigation Banking - This approach has emerged as an alternative to onsite compensation for wetlands loss. In wetlands mitigation banking, larger offsite wetlands are used to mitigate for many smaller development projects. Developers purchase "compensation credits" from the mitigation bank. Wetlands in the bank are created, enhanced, restored, or preserved for this purpose (Environmental Law Institute, 1993).

Wetland mitigation banking potentially can provide greater ecological benefits than onsite, project-specific mitigation - e.g., if the compensation sites are larger and more viable hydrologically and biologically. Also, continuing professional wetland management is more likely to protect water quality than ad hoc management at isolated sites (Environmental Law Institute, 1993).

Ideally, wetlands management will become integrated within comprehensive management programs and the policy of "no net loss" implemented by basin or watershed unit. This approach could provide water quality benefits for the entire basin.

Market-based Solutions - Market-based approaches such as pollutant trading do not have a long history, but some states are developing promising approaches. Pollutant trading between point and nonpoint sources may be feasible in cases where one source category is facing large costs to control pollutants common to other sources. For example, point source dischargers may find it cost effective to provide funds for nonpoint source controls or ecological restoration rather than to add additional treatment. One example is nutrient trading in the Tar-Pamlico Basin of North Carolina, where a consortium of municipalities and other point sources has agreed to fund the State Agricultural Cost Share program for nutrient BMPs in the basin (RTI, 1995). Other market-based applications include wasteload allocation trading among point source dischargers on the same river. Local governments can play a facilitation role in such approaches. In South Carolina, for example, the Bureau of Water Pollution Control hopes to involve regional councils of government in wasteload allocation decisions.

Chapter 4: Getting Started

For most state agencies, switching from program-centered to watershed-centered management involves a fundamental change that will prompt intense scrutiny by staff and administrators. Although such a shift involves changes in *functional relationships* among individuals and programs, it does not necessarily require a change in *organizational structure*. Nonetheless, a significant investment of time is needed to resolve such issues. The use of skilled, outside facilitators can be helpful in effecting change in a timely fashion, but is not always necessary.

The process is unique to each state (see highlights below). However, experience shows that most States face several key challenges:

- Establishing a common direction
- Managing the transition
- Identifying barriers
- Documenting the approach.

These challenges and some ways to address them are described in the following sections. EPA understands that this is not the only way a state can adopt a basin approach. Rather, the information below suggests themes and techniques that have proven useful in several states to date.

4.1 Establishing a Common Direction

Agencies and programs involved in watershed protection are likely to have different perspectives and goals. Successful development depends on strong leadership and support from each participating program. Agency and program staff often want a clear direction and specific mandate before agreeing to participate. This "buy-in" to the approach generally requires a demonstration of long-term commitment by program administrators.

Implementing Statewide Approaches in Delaware and Texas

In Delaware, managers from two separate divisions within the state's Department of Natural Resources and Environmental Control recognized the limitations of operating nonintegrated programs. These managers brought together their staffs and representatives from several other agencies. Through a series of workshops and workgroups, they are developing a core program to integrate the activities of the Division of Water Resources programs (i.e., surface water, ground water, wetlands) with the activities of the Division of Soil and Water Conservation Programs (i.e., NPS management, coastal zone management, sediment, and stormwater).

The State of Texas initiated a process after a Division Director brought the approach to the attention of both the Deputy Executive Director and Chairman of the Texas Natural Resources and Conservation Commission. These top-level administrators, in turn, have instituted an agency-wide review for application of the approach to all programs. A series of educational and discussion sessions led to the establishment of internal workgroups to address preliminary issues and provide the foundation for development of a basin approach.

Administrators can demonstrate their commitment by developing a mission statement that supports the concept of basin- or watershed-centered management. Meetings can be held with staff and managers to develop consensus regarding goals and objectives. The expected products (e.g., basin plans, technical references) and services (e.g., assessment, planning, outreach) should be specified from the outset.

4.2 Managing the Transition

State agency staff and other stakeholders will be very interested in how the operation of programs will change to accommodate watershed management. Several steps can be taken to assure stakeholders that a smooth transition can be accomplished.

- Determine who will direct development:

Planning all the details of basin schedules, stakeholder responsibilities, monitoring plans and other activities is a significant effort. To lead this effort, it is important to have a knowledgeable person with strong communication and organizational skills. The leader may select a core group of contacts throughout the stakeholder agencies to advise and act on process issues. The leader should communicate the anticipated process for development to all participants.

- Establish a resource base for development:

Developing a watershed approach will require an expenditure of staff time to plan, document and implement the approach. Therefore, it is helpful to determine, up front, the

availability of staff resources. Other resources such as federal assistance or outside contracting services can be explored.

- Educate participants on statewide management.
- Educate all staff likely to be involved in the process on the fundamental concepts.
- Establish a means of communication among participants:

Given the significance of the process, agencies should not rely on information to trickle down through supervisors to staff; a network is recommended that reaches all participants directly. Effective methods include newsletters, an electronic bulletin board system, and staff briefings.

4.3 Documenting the Approach

The lead agency should prepare a document that describes the approach for that state. This document, often referred to as the framework document (see Figure 1-3), should include the overall goals and objectives for participating agencies, a definition of the management units for the state, the basin cycle schedule, procedures for developing basin plans, roles and responsibilities of participating programs and agencies, targeting criteria and procedures, and guidelines for public involvement. The framework document serves as a written reference for staff to ensure consistency of application and quality of results. The document also often serves to communicate to the public what the approach involves and how they can better participate in the process.

Figure 4-1 is an outline for a framework document that contains features common to several states. The next highlight presents some of the issues being addressed by the Delaware Department of Natural Resources and Environmental Control in developing a framework for that state.

Executive Summary

Statewide Watershed Management Approach Vision

Long-Term Basin Management Vision

Relationship of Current Basin Approach to Vision

1. Introduction

1.1 Objectives

1.2 Rationale for Approach

1.3 Federal CWA Mandate for Approach

2. Coordination/Integration of Agency Programs/Functions

- 2.1 NPDES Permitting
- 2.2 Monitoring
- 2.3 Financial Planning and Grants
- 2.4 Water Resource Planning
- 2.5 Nonpoint Source Programs
- 2.6 Coastal Zone Management
- 2.7 Drinking Water
- 2.8 Ground Water
- 2.9 Fish and Wildlife

3. Transition Issues and Solutions
 - 3.1 EPA Flexibility
 - 3.2 Organizational Structure
 - 3.3 Coordination with Local Planning Agencies
 - 3.4 Basin Scheduling Process
 - 3.5 Other Issues

4. Major Components of a Basin Management Plan

5. Procedures for Developing Basin Management Plans

6. Statewide Monitoring Plan

7. Data Analysis, Modeling, Presentation (TMDLs)

8. State Financial Assistance

9. Roles and Responsibilities in Basin Approach
 - 9.1 Surface and Ground Water Quality
 - 9.2 Soil and Water Resources
 - 9.3 Other Divisions

10. Implementation Schedule

11. Data Management
 - 11.1 GIS
 - 11.2 Existing Data Management Structures
 - 11.3 Recommended Data Management Structures

Figure 4.1. Example framework document outline.

Key Issues Addressed by Delaware in Developing a Basin Management Framework

- A primary goal in Delaware is to restore and preserve physical habitat that is essential to waterbody integrity.
- The Division of Water Resources will phase-in coordination with other divisions and agencies. The consensus strategy recommended that the Division take the lead in the early phases of development and implementation. This will provide the program with a base of CWA authority and precedence. However, the program description includes a definition of water quality inclusive of biological resources, physical habitat, and watershed linkages to ensure that the Division's approach is consistent with the goals and objectives of programs and agencies that will be partners in subsequent phases. The Delaware approach will ultimately include many of the natural resource programs including the Fish and Wildlife Division, the Parks and Recreation Division, and county planning authorities.
- A statewide monitoring program addresses targeted needs for individual basins (e.g., rotating stations and intensive surveys) and maintenance of a statewide network for monitoring water quality status and trends.
- Transition issues raised in Delaware will require solutions. They include EPA flexibility, workload planning, coordination with local planning agencies, and scheduling basin rotation. Delaware is working actively with EPA Region 3 to make grant funding schedules and requirements more consistent.
- The process for funding through the traditional State Financial Assistance process presented an institutional barrier for implementation. Alternatives involving a geographically targeted risk-based approach are discussed in the framework document.
- Changes to current information management practices are also necessary. Information management is an important issue for most states, especially because the WPA focuses more attention on environmental assessment and involves information from a larger number of data sources.

(see also Delaware Department of Natural Resources and Environmental Control, 1994)

4.4 Identifying Barriers

State agency policies or even individuals may pose obstacles to developing a basin approach. For example, an agency policy or regulation may have provisions contrary to the proposed approach or a key individual may fail to participate in the development process. There may also be staff resistance if organizational changes are necessary to implement the approach. Because the approach encourages direct networking among technical experts in different program areas, some supervisors may have difficulty with the changing supervisor/staff relationship. For example, biologists and engineers might need to work more directly with their peers in other agencies.

To identify concerns and risks of switching to a basin approach, some states have used a workshop setting and outside facilitators who have no vested interest in the approach selected. Positive outcomes may include reduced level of concern and new ideas for resolving issues.

Workshops and workgroups are especially useful for issues that can be resolved in a relatively short time. Involving a skilled and impartial facilitator can also help mediate difficult, long-term issues.

To identify potential impacts to agencies, it may be helpful for states to consider the following questions:

- Will organizational changes be necessary?
- How will changes in methods affect staff and training?
- Are additional resources needed?
- How will the state's relationship with EPA/other agencies be affected?

Once a basin approach has been established, educating the public is critical to building support for the approach. Potential methods include briefing state and local agencies, commissions, and special interest groups about the process and what roles they can play. This important step may be difficult for states to accomplish when so much staff energy is going into developing the basin approach.

4.5 Tailoring the Approach

Once issues of direction and administration have been resolved, a state is ready to develop an approach that will best meet its needs and objectives. Answers to the following questions will guide this effort.

- What are the appropriate management units (i.e., basins and watersheds) to be used by all participants?

As discussed in Chapter 2, basin boundaries should be established as a baseline for all participants in the management process. Too few basin units can result in large, cumbersome basin plans, and too many management units may lead to overwhelming numbers of basin plans.

- In what sequence should those management units be addressed and over what time cycle?

Factors to consider when determining length of the cycle and basin sequence include:

Resource constraints -- available staff and funding may determine length of the statewide cycle and where management strategies are feasible

Balancing workload from year to year (e.g., in permit development, TMDL development, monitoring, and basin plan writing and updating)

Level of activity in a basin -- a state may want to begin with basins where substantial information and management tools are already available

Anticipated degree of public involvement -- a state may prefer to address first those basins with a high degree of public interest and willingness to implement management initiatives

- Which programs should be involved?

Decide which programs should be integrated (e.g., surface water, groundwater, drinking water, wetlands, agricultural runoff control programs). Some states may choose to initiate a basin approach that incorporates only a few programs and plan to incorporate other programs once some success has been demonstrated. Permits or monitoring may be the first programs included due to the expected substantial gains in efficiency from coordinating these activities within a basin management cycle. Other states may choose to initiate an approach that includes all water quality programs. See the next highlight regarding the integration of Massachusetts' drinking water protection program with its basin approach to resource management.

In making its determination of which programs to include, a state may find it useful to list in detail the tasks required to implement basin management (e.g., data collection, data analysis and assessment, priority setting, TMDL development, public participation, plan preparation and adoption, permitting, and other elements). Roles and responsibilities can then be identified for completing these key tasks, thereby identifying the programs and stakeholders that need to be involved.

Comprehensive Source Water Protection in Massachusetts

EPA is actively promoting development of CSGWPPs. Massachusetts is currently working to develop a CSGWPP aimed at integrating protection of both surface water and ground water sources of drinking water using EPA's CSGWPP Guidance as a model. Through this process, the state has begun to identify inconsistencies and gaps in the protection programs for both ground and surface water-based drinking water supplies and to develop recommendations and actions necessary to address those deficiencies.

A critical part of Massachusetts' current effort is the integration of the state's drinking water protection program with its river basin approach to resource management. With development of its Clean Water Strategy in 1993, the state started synchronizing functions within each basin that had previously been carried out in isolation within discreet water protection programs: water quality monitoring; water withdrawal permitting (new wells); mitigation and remediation of nonpoint sources of pollution; and permitting under NPDES. Each of these activities impacts drinking water supplies as well as other waters of the state in some way, and drinking water supplies are critical resources to be protected in each basin. The state's strategy is ultimately to combine ground water and surface water protection program efforts into a unified Source Water Protection Program which will provide protection for all sources of drinking water throughout Massachusetts.

Specific issues to be addressed during development of its Source Water Protection Program include: (a) defining surface water protection areas for reservoirs and river intakes of varying

sizes and types and identifying appropriate land use restrictions in those protection areas; (b) alleviating problems resulting from highway runoff to surface water supplies; and (c) developing a policy for disposal of water supply-generated sludge in drinking water protection areas. Additional opportunities for integration of drinking water protection into the state's basin approach will be identified as the program is developed further.

- What are the desired levels and methods of public participation?

Determine how and to what degree the public will be involved in the process. Potential areas for participation include:

- Data and information collection
- Prioritization of problem waterbodies
- Development of management strategies
- Review of management plans and implementation strategies
- Plan implementation (e.g., by NPS agencies and local governments)

Determine whether the public will have open access to the participating agencies at all times or be limited to specific "windows of opportunity". Also, states should establish which mechanisms of access will be most efficient and effective for both the agencies and the public.

- What interactions among programs are key to effective implementation of the approach?

Identify programs that are affected by products or services from other programs, but are not currently interacting at the most effective level. Some agencies have found it useful to develop a matrix of agency program units and the required elements of the basin process. Such a matrix can help identify redundancies and ineffective interactions among programs.

- How should program activities be scheduled within the basin cycle to ensure coordination?

Work with stakeholders to establish a schedule for key task completion that corresponds to the overall basin management cycle. States should then identify interim products that will be integral to the plan's preparation (e.g., monitoring summaries, analyses, and assessments) and establish the format in which they should be produced and the schedule by which they should be completed. It is particularly important to identify those products that one program area must receive from another before work can proceed, since bottlenecks can affect basin plan preparation and implementation. Often, the review/revision of interim products is necessary before they can be used in the next steps of planning.

Appendix B shows a detailed schedule of activities for Nebraska.

To date, nearly all states that have adopted basin approaches (or are moving that way) are synchronizing NPDES permit expiration dates with the basin management time cycle.

Since the permit program is such a large part of a state's water quality agency, synchronizing permits makes it easier for this activity to be integrated with other components (planning, monitoring, etc.). In fact, increased permitting efficiency was the initial reason that several States such as South Carolina adopted a basin approach. However, a state could choose to bring other programs into the cycle and let permit issuance remain on its own schedule, incorporating permits into the basin plans.

If permitting is synchronized with the basin management cycle, it is recommended that permits expire shortly after the scheduled basin plan adoption date so that plan recommendations can be incorporated into the permits and results can be tracked prior to the next basin plan update. For large basins with many NPDES dischargers, permits may need to be issued over a longer period of time to spread out the workload for agency permitting staff. Permittees can be grouped by sub-basin in this case so that consistency and efficiency factors (e.g., consolidation of public notices and hearings) can be maintained.

- What criteria will be used to prioritize specific waterbodies and watersheds within basins for management action, and how will agency resources be targeted to address specific concerns within those prioritized waterbodies?

In light of resource constraints, participating programs will need to establish criteria to prioritize waterbody segments, watersheds, pollutants of concern, etc., for effective management. Because objectives may differ across programs, it is useful to make prioritization criteria explicit so that program involvement remains efficient and consistent. See Section 2.6.

- What resource or technical support needs must be addressed before the approach can be implemented?

Determine the specific needs of participating programs for implementation (e.g., information management systems, GIS, and modeling capabilities).

- How will basin plans be used?

Establish the intended audience(s) and purpose(s) of your basin plan, identify the level of plan approval that will be required, and outline the anticipated components of a basin plan. See the highlight concerning Nebraska's decisions about the role of basin plans.

The Role of Basin Plans in Nebraska

The Nebraska Department of Environmental Quality (NDEQ) recently held a workshop to reach consensus on the required level of approval, purpose, and audience for basin plans, with the following results:

Level of Approval

- *Long Range* -- plans should be officially adopted as CWA Section 303(e) plans, which require signature of the Governor and approval by EPA.
- *Short Range* -- initial plans should be prepared for approval by the Water Quality Division Director.

Audience and Purpose

- NDEQ -- provide for coordination and direction of programs
- Natural Resource Districts -- provide for information transfer; raise awareness; assist coordination and implementation
- Other state and federal agencies -- inform; direct activities and plan implementation
- Regulated community -- raise awareness of process; communicate reasons for effluent limitations (education tool); aid long-range planning
- Legislature -- communicate; raise awareness of process and resource needs/legislative needs
- General public -- increase awareness of process; improve perception; facilitate participation; help direct citizen monitoring efforts
- EPA -- address program plan requirements; expedite required approvals; indicate resource needs; aid in program coordination/implementation
- Special interest groups (e.g., power utilities, agricultural industries, environmental groups) --raise awareness of process; improve perception; facilitate participation; help direct special monitoring efforts.

- Once implemented, how will the basin approach and its component programs be administered?

It may be helpful for states to review operating agreements or state programs supported by federal funds to identify areas where revisions or consolidation are needed. Multiple grants often result in complex administrative burdens. Consultation with EPA and other participating federal agencies may result in possibilities for block grants or other mechanisms to encourage program integration. Where feasible, program plans should be revised to support implementation. Also, new interagency memoranda of understanding may be needed.

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Appendix A: How Does Ground Water Protection Fit?

A.1 Perspective

Considerable concern has been expressed by water resource managers about how ground water protection is integrated with a statewide basin approach. The need for integrating surface and ground water is clear since the quality of ground water contributes to the general condition of a watershed and may serve as a medium for transporting pollutants to surface waters.

Furthermore, by coordinating the state's basin approach with its Comprehensive State Ground Water Protection Program (CSGWPP), a state may be able to leverage the authority and resources of programs outside the normal surface water management arena. Starting in 1984, EPA began working with states to create ground water protection strategies to coordinate efforts under some 20 federal ground water programs. There are ground water provisions focusing on hazardous substances impacts through programs under the Resource Conservation and Recovery Act and the Comprehensive Environmental Response, Compensation, and Liability Act governing waste disposal sites and remediation of Superfund sites. Initiatives under the Federal Insecticide, Fungicide and Rodenticide Act regulate the use of agrichemicals. The Safe Drinking Water Act encourages states to develop Wellhead Protection Plans and allows the designation of Sole Source Aquifers to provide additional safeguards from the impacts of various federally assisted projects.

The states' CSGWPPs integrate these various programs and activities. Also, many states use surface water quality standards under their CSGWPPs to provide site-specific ground water protection standards. Thus, a state's CSGWPP and its basin management activities can reinforce each other's goals. In fact, the effectiveness of the state's basin approach may depend on how well these basin management activities and the CSGWPP integrate important regional or site-specific concerns.

A.2 Surface/Ground Water Issues at the Basin and Watershed Levels

Basin management plans under a statewide basin approach should identify surface/ground issues at both the basin and watershed level. At the basin level, certain issues tend to be broad in scope, sometimes extending across all or part of a basin, for example:

- Large areas of Kentucky, Tennessee, Virginia underlain with limestone caverns where land disposal or direct pollution of sinkholes can rapidly contaminate both surface and ground water for many miles
- Parts of Florida with underlying coral and limestone formations and underground streams
- The Eastern Snake River Plain Aquifer, where activities in the basin (e.g., irrigation, Superfund sites) have the potential of contaminating both the aquifer and the Snake River itself; the aquifer is now designated as a Sole Source Aquifer

- Portions of Arizona and elsewhere in the arid west where activities such as agriculture or mining tap into alluvial aquifers, draining them and causing loss of critical riparian habitat

State basin management plans also identify watershed-specific issues for special attention in future watershed projects. Examples of watershed-level issues affecting surface and ground water include localized problems with solid waste disposal in sinkholes, protection of springs, pollution of surficial aquifers by land activities, and localized sites where recreational activity in caverns has caused damage to sensitive aquatic biota.

A.3 Challenges Specific to Ground Water Protection

There are many opportunities for integrating surface water and ground water protection. This is particularly the case where shallow aquifers, which are often highly susceptible to contamination, are directly connected to surface waters. In other respects, however, ground water protection presents challenges that differ in kind or scale from those encountered in protecting surface waters. For example, given the enormous costs and technical difficulties of ground water remediation, considerable emphasis must be placed on pollution prevention. In contrast, because surface waters are generally easier to clean up, greater emphasis under surface water programs can be given to restoring impaired waterbodies.

Other ground water-specific concerns that should be considered when designing broad protection approaches include ground water pollutant fate and transport mechanisms, monitoring considerations and resource boundaries, (e.g., aquifer boundaries may not coincide with basin boundaries). Because ground water generally flows slowly, there is often a long lag time (sometimes decades) between discharge of pollutants at the land's surface and their transport through an aquifer. This may make it difficult to locate sources of contamination and has obvious implications for enforcement and for evaluating environmental effectiveness of protection efforts. Ground water problems thus are often treated as nonpoint source pollution or in-place contaminant concerns.

Monitoring ground water quality involves sampling existing or new wells for pollutants of concern. Monitoring ground water can be very expensive compared with monitoring surface water, especially if a large network of new monitoring wells must be installed and extensive laboratory analyses of ground water consistent with the state's priorities and schedules are implemented.

CSGWPPs should be carefully coordinated with the state's general, long term Watershed Protection Approach. For maximum effectiveness in protecting water resources, states need to make conscious decisions on how CSGWPPs and basin approaches can most profitably align. The following highlight describes how Nebraska deals with interrelated ground water and surface water pollution issues.

Linking Surface and Ground Water Management in Nebraska

Nebraska's basin approach includes both surface water and ground water programs. Although the approach is not designed specifically for ground water, various ground water protection programs within the state are moving to a more basin-by-basin approach. The state's Wellhead Protection Program annually targets communities in selected basins to receive a more focused Wellhead Protection effort. Also, educational activities in Nebraska's CWA Section 319 nonpoint source program are coordinated with the state's basin approach. Furthermore, septic tank and underground injection control program activities are targeted to different basins in successive years.

In addition to these state-level activities, ground water management plans for dealing with ground water supplies and nonpoint sources of contamination have been developed and implemented by each of the 23 Natural Resources Districts (NRDs) that cover the state. Basin plans will be coordinated with the ground water management plan for each appropriate NRD. Since the Districts' boundaries generally follow basin delineations, they provide a logical geographical management unit for coordinating watershed protection activities at the local level. The NRDs already sponsor a large number of CWA Section 319 nonpoint source implementation projects across the state. Several NRDs have worked with the Nebraska Department of Environmental Quality to develop and implement Special Protection Areas, while other NRDs have independently developed and implemented their own Ground Water Quality Management Areas. Both designations deal with the management of nonpoint source ground water contamination. Consequently, although ground water activities in Nebraska are not specifically included in the basin approach, in effect the state's high-priority ground water concerns are being addressed basin by basin.

Appendix B: Management Cycle for the State of Nebraska

Management activities within Nebraska's thirteen delineated basins will be coordinated around a five-year cycle. A series of steps are executive for each basin over the cycle, ending with the promulgation and implementation of a management plan. These steps are illustrated in Figure 1 and described below in more detail.

Step 1. Draft Strategic Monitoring Plan

A strategic plan will be drafted that specifies monitoring to support basinwide assessment. Details shall include monitoring objectives, station locations, parameter coverage, sampling frequency, and monitoring plan rationale.

Step 2. Initial Public Outreach

As resources allow, NDEQ will hold public meetings at appropriate sites within the basin to acquaint stakeholders with the overall framework and help identify management concerns specific to that basin. It is anticipated that the format of the meetings will generally follow that used for Nebraska Wetlands Conservation Plans, which includes Open House sessions, large group presentation, and small group discussions. Relevant portions of the NDEQ strategic monitoring plan will be presented with an explanation of how the resulting data will be used for assessing water quality and prioritizing management needs. This initial outreach will provide stakeholders with opportunities early in the basin planning process to submit relevant information, identify potential gaps in the monitoring strategy, participate in data collection where appropriate, or provide other feedback.

Step 3. Implement Strategic Monitoring Plan

The strategic monitoring plan for basinwide assessment will be implemented following any modification resulting from feedback received during initial outreach activities.

Step 4. Canvas for Information

NDEQ will make direct contact with key agencies and other entities to obtain additional relevant information for use in basin planning. In particular, data will be sought for characterizing the basin (e.g., hydrology, land-use, population demographics, economic base, etc.) and for evaluating water quality. Stakeholder information will also be used where appropriate in the prioritization and management strategy development process.

Step 5. Analyze Information

Initial analyses of basinwide monitoring data and supplemental stakeholder information will focus on determining use support status, identifying problems and areas of special ecological value, and assessing information gaps. Limitations in data coverage should be specified so that initial findings can be appropriately qualified. Some quantification of problems may occur to

clarify causes and sources, estimate loading, and quantify assimilative capacity. Further analysis and more detailed quantification of problems will continue for waters that are prioritized in the next step. Known gaps in field data will be addressed during updates of the strategic monitoring plan.

Step 6. Prioritize Problems and Critical Issues

NDEQ will apply a standardized set of criteria and procedures to prioritize waterbodies in need of management or additional assessment so that resources can be targeted to address the concerns in an efficient and effective manner.

Step 7. Continue Public Outreach

NDEQ will present potential stakeholders with a summary of the initial water quality assessments and recommended management priorities. Areas in need of further problem quantification will be identified. NDEQ will attempt to match stakeholders to corresponding priority waterbodies. In some cases, "Focus Groups" may be formed among stakeholders to help clarify matters. Stakeholder and Focus Groups will form the basis for stakeholder involvement in the evaluation of management options and development of basin management plans.

Step 8. Implement Updates to Strategic Monitoring Plan

Based on the results of initial assessment and prioritization, along with feedback from public outreach activities, NDEQ will update and implement its strategic monitoring plan to gather data for further problem quantification. This will include data for model development or other tools necessary to evaluate management options.

Step 9. Problem Quantification

Additional problem quantification will be performed where required to establish the magnitude of a problem, determine assimilative capacity, calculate loads for contributing sources of pollutants of concern, or otherwise further assess the problem such that sufficient information is available for management strategy development. This includes field calibration of models and development of total maximum daily loads (TMDLs).

Step 10. Develop Management Strategies

NDEQ will work with other stakeholders to arrive at a consensus on management goals, such as specific waterbody segments to be restored or protected. This will include loading reductions that should be achieved, or the amount of habitat that needs restoring, etc. Input will also be solicited from stakeholders to establish feasible combinations of point and nonpoint source control measures and management actions to achieve goals. Management options will be evaluated via predictive modeling, or by other methods where appropriate, for their relative effectiveness at achieving environmental objectives. Regulatory constraints and procedures will be considered, and stakeholder consensus will be sought where voluntary efforts are needed to meet environmental objectives. Selected management strategies will outline mechanisms for

implementing controls, time frames, anticipated costs, sources of funding, monitoring strategies, compliance tracking and enforcement methods, etc.

Step 11. Prepare Draft Basin Plan

NDEQ will prepare a draft basin plan which documents the results of the basin planning process including assessment, priorities, goals, selected management alternatives, and the implementation strategy.

Step 12. Agency and Public Review

An internal review of the draft basin plan will be performed to ensure that it is ready for public distribution. Upon agency approval, the plan will be made available for public review and comment. Outreach will be provided to explain provisions and implications of the plan.

Step 13. Complete Final Basin Plan

Modifications will be made to the plan, as necessary, based on comments and input received through the review process, to complete a final basin plan.

Step 14. Basin Plan Implementation

Each cycle ends with a basin plan implementation period. The implementation strategy outlined in the plan will be followed, taking such steps as necessary to implement pollutant source controls, best management practices, monitoring programs, enforcement methods, etc. Activities occurring during this period will include public notice and issuance of NPDES individual and basin general permits, distribution of state revolving fund (SRF) loans to prioritized entities, and allocation of 319 funds to prioritized NPS problem areas. In addition, implementation will include an outreach component to communicate the goals and selected management strategies of the final plan. Outreach will also be used to educate stakeholders on implementation schedules, milestones, and where regulatory and voluntary efforts are required to meet environmental objectives.

The final basin plan contains recommendations for follow-up basinwide assessment to measure the degree of success from plan implementation and to evaluate areas that were not assessed during the previous cycle. After a specified period of time for plan implementation, NDEQ will implement the updated strategic monitoring plan and the basin management cycle will be repeated.

The basin management cycle will not be initiated in all basins at the same time for practical reasons. Activities within the thirteen basins will be sequenced so that steps are performed incrementally across the state. This helps to balance program workloads. Focusing on the same steps at one time in a small segment of the state creates a more efficient and effective operating framework.

Table 1 shows the sequence and scheduling of steps for Nebraska's thirteen river basins. The order in which river basins will be addressed is shown along the left hand column of the table. Corresponding schedules for performance of each step of the basin management cycle are shown to the right of the column of basins. Two lines of symbols are used for each basin to better depict simultaneous activities (Note: symbols are defined in the legend at the bottom of the table). The table shows how steps are phased in across the state over the first five-year cycle from 1994 to 1998. Basinwide management activities will be ongoing in all basins across the state by 1998, and basin management plans will be implemented for all basins by the end of 2001.

Specific scheduling patterns have been incorporated within the basin cycle. For instance, the vast majority of field monitoring activities for NDEQ's Water Quality Division are performed between May and November for scientific reasons. Therefore, strategic monitoring plans will need to be finalized by the end of April each year so that actual sample collection can begin in May.

Data analysis (A) and problem quantification (Q) are shown in the table under the months of November through February following the first year of monitoring and information collection. However, this does not mean that analysis and quantification are restricted to that period. Rather, this is the period where data are screened and assessed for watershed prioritization purposes. It is recognized that analysis and quantification for purposes of evaluating management options will continue on in some prioritized watersheds up until development of management strategies and written plans. This is illustrated in the table by the series of months with a *Q* following the *Mq* period.

Finally, it should be noted that the length of time scheduled for follow-up problem quantification and management strategy development differs across basins that are grouped in the same year of the cycle. The times have been staggered so that only one basin plan is being drafted at a time. For example, plan drafting will occur in July-August of 1996 for the Lower Platte whereas the basin plan for the Nemaha will be written in November-December, 1996. This same type of pattern is repeated for each year of the basin cycle.