Clean Water for Texas

Solving Water Quality Problems

Water. We can't live without it. We use it for drinking, business, farming, and many other purposes. Water adds beauty to the landscape and provides habitat for many species of plants, animals, and aquatic life. The importance of water has led to the creation of state and federal laws designed to define and protect water quality. Following those laws, the Texas Natural Resource Conservation Commission (TNRCC), working with other state and regional water management agencies, has prepared an inventory of Texas water quality and has identified stream segments (portions of water bodies) that do not meet the standards set for their use.

It will take a concerted effort of state, regional and local governments, concerned citizens, and public interest groups to address substandard conditions in segments caused by such activities as urban growth, suburban development, mining, industry, and agriculture. The foundation of the state's efforts to restore and protect our rivers, lakes, and streams is the watershed management approach, which encourages local control, empowers communities, and relies on public participation. In the pages ahead, we examine the types and sources of water quality problems, review laws governing water quality management in Texas, and address local, regional, and statewide solutions.

The TNRCC's Framework for Implementing Water Quality Management

The Law

Under the federal Clean Water Act (CWA), states must define how water bodies will be used [for example, drinking water, contact recreation (swimming and fishing), or aquatic life support (habitat for fish and other water-dwelling species)] and establish standards that serve as goals for water quality. The state must also have a regular monitoring program in place to determine whether water bodies meet their standards. Monitoring enables the state to prepare a required inventory of the status of all the classified water bodies. The inventory provides the basis for the CWA §303(d) List, which identifies and prioritizes water bodies that do not meet their designated uses. The state is then required to establish a consistent process for restoring the quality of these impaired (or priority) waters. These two basic mandates, identifying polluted water bodies and implementing action plans to restore them, provide the impetus for water quality management programs at the local, state, and regional levels.

The TNRCC's watershed management approach has evolved from this federal law, as well as from 1991 state legislation that created a watershed-based water quality assessment program. The state legislation also included provisions for issuing wastewater permits on a watershed basis, establishing basin steering committees as a forum for public input, and providing state funding for the program.

Water Quality Impairments

The TNRCC identified problems in 142 of the 368 classified water segments in Texas. The sources and types of impairments identified in the 1996 CWA §303(d) List are summarized in Tables 1 and 2. The problems identified in these priority watersheds clearly indicate a complex array of water quality issues that need to be addressed throughout Texas. While the TNRCC is designated by law as the lead agency for water quality management, the responsibility for restoring these polluted segments falls to multiple agencies.

The Clean Water Act requires the state to address all problems identified on the 303(d) List. This makes the list a primary decision-making tool for determining priorities for TNRCC water quality management program activities. The list will, in turn, have an impact on local and regional activities aimed at protecting

TABLE 1. 1996 CWA §303(d) LIST SUMMARY

Sources of Impairment

Source	Segments Affected
Number of segments that do not support or partially support their designated use	142 Segments
Nonpoint source (NPS) only	62 segments (44%)
NPS and point source (both)	43 segments (30%)
Point source or natural source only	37 segments (26%)

TABLE 2. 1996 CWA §303(d) LIST SUMMARY

Causes of Impairment

Contaminant	Use Impaired	Segments Affected
Fecal Coliform	Recreation, Shellfish	117 segments (82%)
Dissolved Oxygen	Aquatic Life	38 segments (27%)
Metals	Aquatic Life	28 segments (20%)
Organics	Aquatic Life	19 segments (13%)
Dissolved Solids	Aquatic Life	19 segments (13%)

and restoring local water bodies. It will be used to recommend priorities for future water quality monitoring, development of watershed action plans, intergovernmental coordination, and nonpoint source pollution management.

What Causes Pollution?

Water pollution comes from point sources, which can be traced to a specific location such as a pipe or disposal site, and from nonpoint sources, which are pollutants carried by rainfall runoff from sites including lawns, construction areas, farms, or highways. Point sources of pollution are controlled by such means as water treatment and regulatory permits. Nonpoint sources are more difficult to control because they often come from everyday activities such as lawn fertilization, pesticide use, new construction, or crop irrigation. Understanding the specific sources of the problems is the first step toward protecting the quality of each watershed.

Metals

Metals, like cadmium and lead, are toxic substances. At levels higher than the standards set for them, metals pose a threat to drinking water supplies and human health. The accumulation of these substances in humans, caused by eating fish contaminated with metals, is the most serious threat to human health from these pollutants. Metals also pose a threat to livestock and aquatic life. Problems caused by metals are primarily from urban runoff and come from cars and industry. Metals can also come from some agricultural practices and from natural sources because metals are naturally present in the ground. Potentially dangerous levels of metals and other toxic substances are identified through chemical analysis of water, sediment, and fish tissue samples.

Organics

Organics include toxic substances from pesticides and industrial chemicals, and pose the same concerns as metals. Polychlorinated biphenyls (PCBs), for example, are a class of industrial chemicals that are toxic and probably carcinogenic. Although banned in the United States in 1977, PCBs remain in the environment, and they accumulate in fish and human tissues when consumed. Carcinogenic pesticides, including those now banned, also persist in the environment.

Dissolved Oxygen

A water body that can support aquatic life is a good indication of high water quality. In some ways, a healthy aquatic life system is a better indicator than physical or chemical measures because aquatic species depend on the amount of oxygen available in the water to live. The level of dissolved oxygen is a single, easy-to-measure characteristic of water that correlates with the occurrence and diversity of aquatic life in a water body. Low levels of dissolved oxygen do not support aquatic life needs.

A closely related problem is an excess of nutrients in the water. Nitrogen and phosphorus compounds are important plant nutrients which, in large quantities, can cause excessive growth of aquatic vegetation. This excessive vegetation, in turn, can cause low dissolved oxygen. Common nutrient sources are fertilizers from farms and ranches, lawns, and golf courses; wastewater; and other urban nonpoint sources.

Dissolved Solids

Dissolved solids include problems like too much salt or sediment in the water. Salt concentration, or salinity, is important because if it is too high, the water is unusable or costly to treat. Salinity can be caused by natural sources or human activities. For example, irrigation waters have a high evaporation rate, leaving salt concentrations that seep into groundwater and eventually into surface waters. Salts are also concentrated in the soil when plants take up water. Another problem that falls in this category is excessive sediment, or dirt and other materials that settle at the bottom of the water body. Excess sediment usually results from erosion, which can be caused by poorly managed construction sites or agricultural land. Too much sediment can impair stream flows and aquatic life support.

Fecal Coliform Bacteria

Fecal coliform bacteria are measured to determine whether water is safe for swimming (contact recreation). Fecal coliform bacteria originate from the wastes of warm-blooded animals and can reach a body of water from inadequately treated sewage, improperly managed animal waste from farm livestock, pets in urban areas, aquatic birds and mammals, or failing septic systems.

Actions to Address Impairments

In collaboration with the Texas State Soil and Water Conservation Board and the U.S. Environmental Protection Agency (EPA), the TNRCC has established strategies for addressing the problems in Texas waters. The TNRCC's initial action plan organizes the segments on the 303(d) List into five major categories based on the type of action recommended to address the impairments of each segment.

1. **Complete total maximum daily loads (TMDLs) currently underway**

   The TNRCC is conducting TMDLs for a

Total Maximum Daily Loads

Under the Clean Water Act, §303(d), the state is required to develop and implement total maximum daily loads (TMDLs) for all pollutants preventing or expected to prevent the attainment of water quality standards. TMDLs, which can be costly and time consuming to develop and execute, are detailed technical assessments of water quality impairments. A TMDL is an estimate of the maximum amount of pollution a body of water can receive and still meet water quality standards. A TMDL must address the specific pollutant causing the impairment, whether it originates from point or nonpoint sources. While this sounds simple, it can become quite complex. A river basin contains many smaller watersheds; thus there might be several TMDLs developed within one river basin. Within an individual watershed, it may be necessary to develop a separate TMDL for each different pollutant causing a standards violation.

Watershed Action Plans

A watershed action plan is a quantitative assessment of water quality problems and contributing pollutant sources, along with an implementation plan that identifies responsible parties and specifies actions needed to restore and protect a water body. TMDLs are the scientific basis for watershed action plans, and provide the foundation necessary to identify appropriate management objectives and strategies. Watershed action plans provide critical direction for managers at the local, regional, and state levels by establishing implementation schedules and identifying potential sources of funding. The TNRCC's watershed management approach coordinates the technical assessment of impairments in priority watersheds and the subsequent implementation of necessary management strategies at the local level.

select group of segments in the watersheds of basin groups B, C, and D (see map, Figure 2). These TMDLs address concerns related to metals and low dissolved oxygen. When the TMDLs are completed, they may result in waste load allocations, watershed action plans, or both.

2. **Recommend candidates for initiating a TMDL in FY98 or FY99**

   Other watersheds have been selected as candidates for the development and implementation of TMDLs beginning in FY98 and FY99. Problems in these segments include high priority issues such as metals

What Is a Watershed?

Everyone lives in a watershed, or drainage basin, which is defined as a geographic area in which water, sediments, and dissolved materials drain into a common body of water. The body of water could be a stream, lake, playa, estuary, aquifer, or ocean. A watershed can be as large or as small as you want to define it. In a city, the gutters that run along the curb on your street are the drainage outlets for your street's watershed. The water in the gutters that drain the small watershed of your neighborhood flows into the storm drain system and empties into a nearby stream, which drains several streets in a larger watershed. That stream, in turn, flows into a larger stream or river. Everything that is done in a watershed can affect the quality of the receiving water body.

or other toxics, and low dissolved oxygen. The candidates were chosen based on the following criteria:

- the source of impairment is generally agreed upon;
- the source of impairment is generally attributed to both point and nonpoint sources of pollution, resulting in the need to establish specific pollution reduction targets for different sources of contaminants; and
- there is local support for implementing management controls to address the impairment

Watershed action plans may be developed and implemented for these watersheds after completion of the TMDLs, depending on the results of the TMDL.

3. **Review existing data and the appropriateness of water quality standards**

   For a small group of segments, the TNRCC has determined that additional assessment of historical data is needed to establish whether the standard applied to the segment is appropriate. The types of problems in this category include high salinity, excess sediments, and elevated water temperatures.

4. **Improve TNRCC monitoring and assessment methodologies**

   The additional collection of water quality data using revised sampling techniques is required for some segments on the list. Additional data may be needed for one or more of the following reasons:

   - the source of impairment is not agreed upon or is unknown;
   - the source of impairment is generally attributed to natural sources or conditions;
   - a point source control has been recently implemented; and
   - the number of samples or their geographic distribution is too small to define the impairment and justify expenditure of funds to initiate a TMDL.

5. **Address standards compliance and sampling methodology through a statewide fecal coliform study**

   Water quality standards are impaired in 82 percent of the segments on the 303(d) List as a result of elevated levels of fecal coliform. Technical staff believe that either the standard or the sampling methodology may be incorrect, so the TNRCC proposes

further study of these segments under a targeted monitoring strategy before deciding whether these segments are appropriate for TMDL development.

After further study of segments in categories 3, 4, and 5 the TNRCC will decide which watersheds need TMDL development. This determination will allow the state to focus funds for TMDLs where they are most needed and prevent unnecessary expenditures.

A Watershed Management Approach

As more emphasis is placed on developing and implementing watershed action plans and TMDLs, there will be a growing need to coordinate the efforts of responsible agencies and document stakeholder[1] agreements such as pollution reduction goals, pollutant load allocations, management solutions, funding options, and implementation schedules. The watershed management approach will provide the process by which action plans will be developed and implemented to protect and restore our water. The approach will also coordinate routine management activities, like monitoring, which must continue on a regular cycle while activities to address TMDLs are conducted.

The basin management cycle consists of five sequenced activity phases that are repeated for each basin group at fixed five-year intervals. Fixing the timing and the sequence of activities ensures that management goals, priorities, and implementation strategies are routinely updated and completed. The phases, and the activities that take place in them, are outlined in Figure 1.

The watershed management approach will be implemented in each river basin based on a schedule established by the Texas Water Code (Figure 2). Within each river basin, stakeholders will be recruited to participate in the development and implementation of action plans for their priority watersheds.

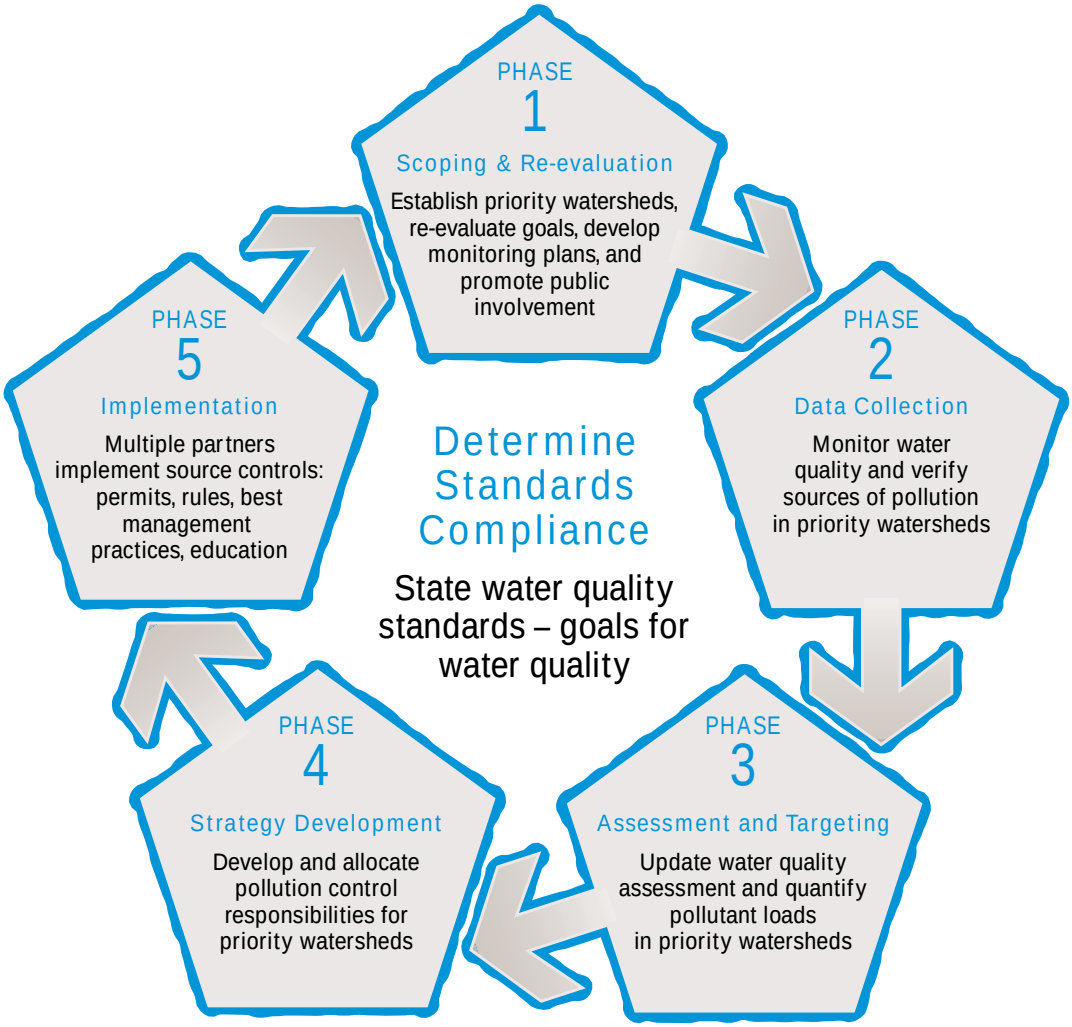
Watershed Action Plan Development

Action plans for priority watersheds will evolve as each of the five phases of the basin management cycle is completed. The process includes targeting the specific pollutants, setting quality

[1] A stakeholder is defined as any person or agency involved in or affected by watershed management activities, including the general public and the regulated community.

FIGURE 1.

The Basin Management Cycle



control measures, reviewing current information and collecting new data from existing monitoring programs, developing watershed and water quality models, and developing management alternatives. Local basin steering committees will provide a forum for developing consensus on final watershed management strategies. Key stakeholders within priority watersheds will work together throughout Phases III and IV of the basin management cycle to develop cost-effective management strategies to address the point and nonpoint source impairments. The TNRCC and local stakeholders will follow these steps to complete plans tailored to address the impairments in their watershed: 1) clarify watershed-specific management goals and objectives; 2) identify the most promising management alterna-

Group A - 1996

Canadian River
Red River
Sulphur River
Cypress Creek
Sabine River
Sabine Pass
Neches River
Trinity River

Group B - 1997

Trinity River (cont.)
San Jacinto River

Group C - 1998

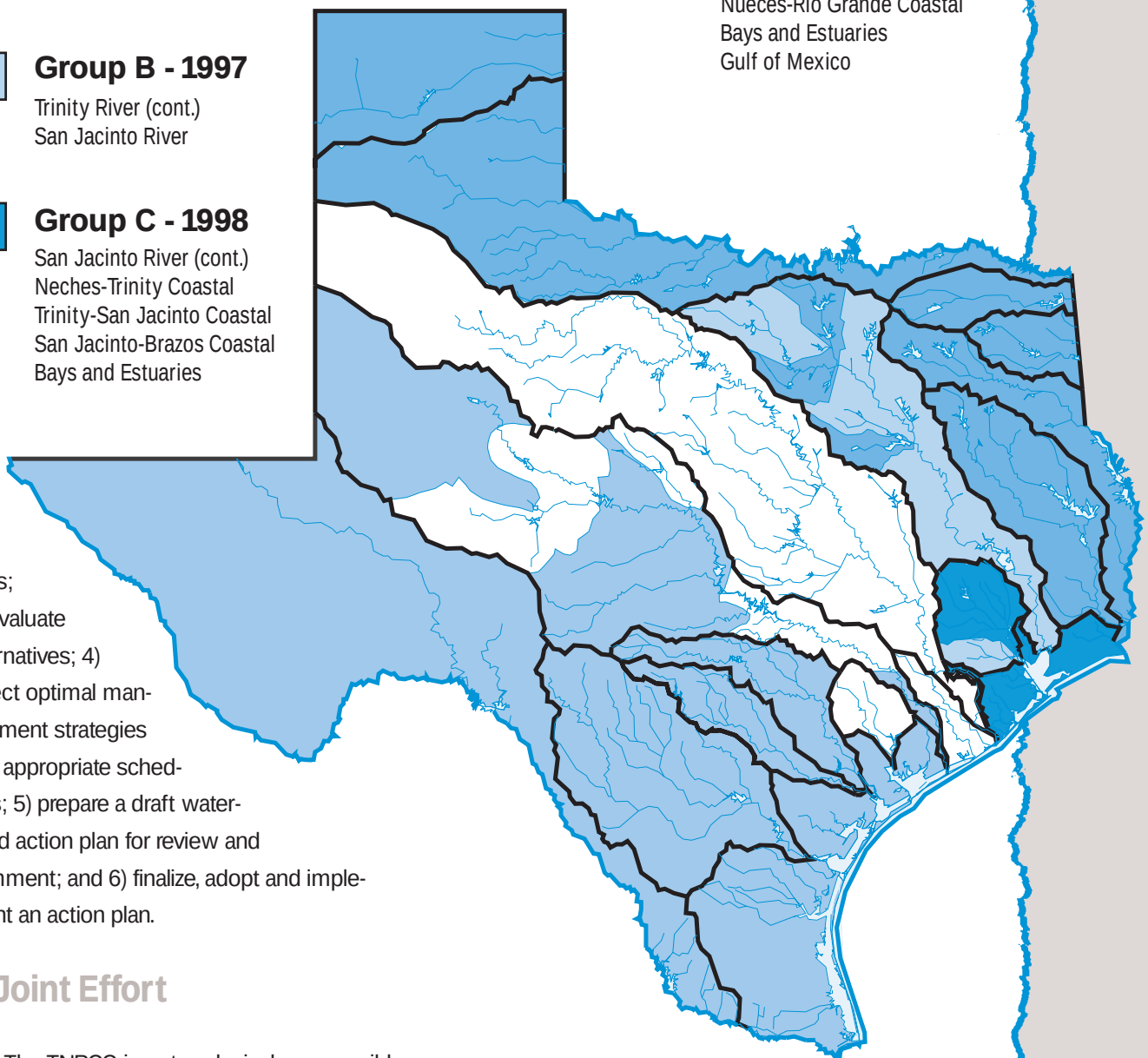
San Jacinto River (cont.)
Neches-Trinity Coastal
Trinity-San Jacinto Coastal
San Jacinto-Brazos Coastal
Bays and Estuaries

Group D - 1999

Brazos River
Brazos-Colorado Coastal
Lavaca River
Colorado River
Bays and Estuaries

Group E - 2000

Colorado River (cont.)
Guadalupe River
San Antonio River
Rio Grande
Nueces River
San Antonio-Nueces Coastal
Colorado-Lavaca Coastal
Lavaca-Guadalupe Coastal
Nueces-Rio Grande Coastal
Bays and Estuaries
Gulf of Mexico



tives; 3) evaluate alternatives; 4) select optimal management strategies and appropriate schedules; 5) prepare a draft watershed action plan for review and comment; and 6) finalize, adopt and implement an action plan.

A Joint Effort

The TNRCC is not exclusively responsible for managing water resources or cleaning up the environment. Citizens, businesses, agricul-

FIGURE 2.

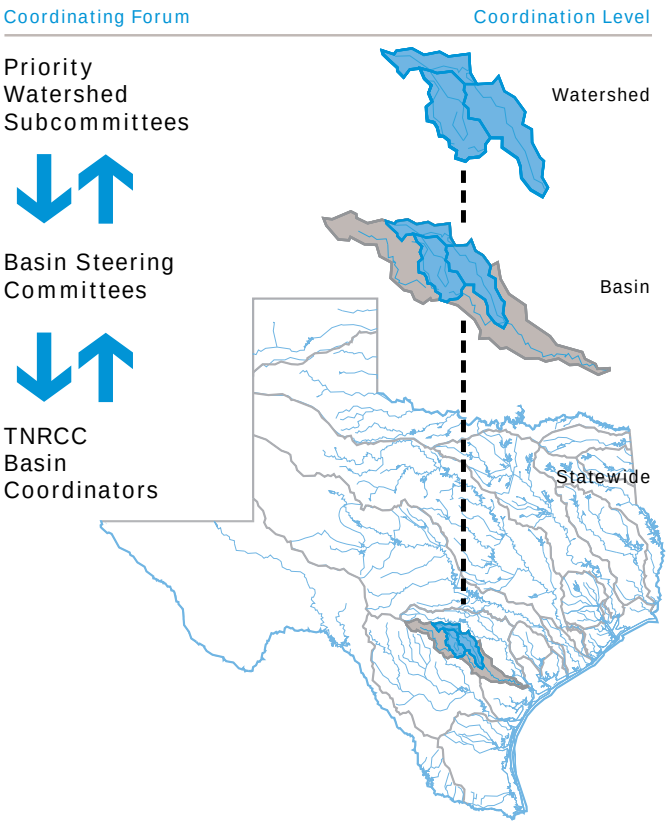
TNRCC Basin Groups

ture, universities, and government agencies must work together to ensure the protection and restoration of water resources and aquatic habitat. The watershed management approach enables all interested stakeholders to cooperate and participate with government. Through these partnerships, the TNRCC strives to improve the means to implement cost-effective solutions for improving and protecting the environment. Coordination of stakeholders is needed at three levels:

- Statewide for agencies and organizations that conduct watershed management-related activities across the entire state and therefore need a broader structure for coordination of efforts;
- Basin-wide for assessing water quality conditions within a basin and establishing basin-specific management goals and priorities; and
- Within local watersheds to rally public support and participation of stakeholders to establish watershed-specific action plans that incorporate nonregulatory and regulatory mechanisms to protect or restore water quality.

FIGURE 3.

Primary Forums for Stakeholder Participation



Gathering Public Support

Public participation, provided through the basin steering committee forum, is important to the success of the watershed management approach. Through the consensus-building activities associated with the watershed management process, public support is gathered for accomplishing the activities that will achieve environmental goals. Management strategies include permit effluent limits and recommendations, urban or agricultural best management practices, stream standard revisions, nonpoint source pollution projects, pollution prevention, public education, and watershed-specific rule recommendations. Phase V includes the documentation, adoption, and initiation of these management strategies. By documenting strategies, methods of funding, and schedules, all stakeholders will have a reference to follow to ensure that commitments are being met during implementation.

Moving Ahead

The TNRCC will begin working with stakeholders in each basin group to identify the most appropriate 303(d) List segments in their areas for TMDL development. Other basin groups will initiate the development of watershed action plans as they reach Phase I of the basin management cycle. New guidance for TNRCC partners coordinates monitoring to support TMDL development and further describe impaired segments. The basin management cycle will ensure that activities move toward watershed action plans development and TMDL implementation, while leveling the work load for statewide programs to an attainable level.

Risk of Litigation

While achieving water quality goals is a sufficient reason for restoring and preserving water bodies, a further impetus is provided by the fact that 25 lawsuits have been brought against the EPA in states where TMDL development has been slow or delayed. High costs and limited resources to support projects of such magnitude have kept many states from complying with the intent of the law. The lawsuits are brought against the EPA because the Clean Water Act requires the EPA to carry out TMDL development in states that cannot develop and implement them in a timely manner. Cooperative action from all stakeholders in meeting time frames set in the watershed management approach ensures that Texans will be able to decide how to manage local water quality.

Economic Consequences

The economic consequences of TMDLs can be significant. In some instances, they result in local controls that can affect economic activities such as construction, forestry, industry, or agriculture. The immediate cost is also steep. For example, a TMDL conducted on the Houston Ship Channel cost approximately $240,000 and took four years to complete. At the other end of the spectrum, a TMDL for nutrients in Long Island Sound took nearly 12 years and cost approximately $19 million. Those figures do not include implementation costs. It is clear that a coalition of government and citizens will be necessary to get the job done.

For More Information

To get involved with water quality in your area, contact the regional management agency for your river basin or the TNRCC central office. Mailing addresses and other information about regional management agencies are available on the TNRCC web site at: www.tnrcc.state.tx.us/water/quality/data/wmt/.

Angelina & Neches River Authority
(Upper & Central Neches Basin, Angelina Basin)
(409) 632-7795

Brazos River Authority
(254) 776-1441

Guadalupe-Blanco River Authority
(830) 379-5822

Houston-Galveston Area Council
(San Jacinto Basin, Trinity-San Jacinto, San Jacinto-Brazos, and Brazos-Colorado Coastal Basins)
(713) 627-3200

Lavaca-Navidad River Authority
(512) 782-5229

Lower Colorado River Authority
(Colorado Basin)
(512) 473-3200

Lower Neches Valley Authority
(409) 892-4011

Nueces River Authority
(Nueces and Nueces Coastal Basins)
(210) 278-6810

Red River Authority of Texas
(940) 723-8697

Sabine River Authority
(409) 746-2192

San Antonio River Authority
(210) 227-1373

Sulphur River Basin Authority
(870) 774-2144

TNRCC
(Rio Grande River and Cypress Creek Basins)
(512) 239-4411

Trinity River Authority
(817) 467-4343

To receive a copy of *The Statewide Watershed Management Approach: The TNRCC's Framework for Implementing Water Quality Management* (publication number GI-229), call TNRCC Publications Inventory and Distribution at (512) 239-0028, or write:

The Texas Natural Resource Conservation Commission
MC195
P.O. Box 13087
Austin, Texas 78711-3087

You can also visit our Web site at: http://www.tnrcc.state.tx.us.

You can browse or download *The Statewide Watershed Management Approach* at: www.tnrcc.state.tx.us/admin/topdoc/gi/229.

For additional information about this brochure, please call the Data Collection Section of the TNRCC at (512) 239-4411, or write to the address above, substituting MC150.

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Printed on recycled paper with soy-based ink.

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