PRESERVING & IMPROVING WATER QUALITY

The Programs of the Texas Commission on Environmental Quality for Managing the Quality of Surface Waters

GI-351 (Sept. 2006)

CONTENTS

Abbreviations in This Document

State Agencies

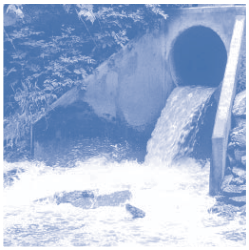
TCEQ—Texas Commission on Environmental Quality
TPWD—Texas Parks and Wildlife Department
TSSWCB—Texas State Soil and Water Conservation Board
TWDB—Texas Water Development Board

Federal Agency

USEPA—United States Environmental Protection Agency

Program Names, Other Terms

CRP—Clean Rivers Program
NPS—nonpoint source
TMDL—total maximum daily load
WPP—watershed protection plan

WATER is an elemental part of our lives. It quenches our thirst. We swim in it, boat on it, and eat the fish we catch from it. We depend on it to irrigate our farms, to water our livestock, and to run our businesses. We want it to be clean and safe for all of those uses.

The Texas Commission on Environmental Quality is charged with managing the quality of water resources in Texas. However, the job of protecting our environment is complex, and requires cooperation from many parties. Governmental and nongovernmental organizations and citizens must work together to protect and restore water resources.

Key Partners in Managing Water Quality

Texas State Soil and Water Conservation Board
Texas Parks and Wildlife Department
Texas Department of State Health Services
Texas Forest Service
Texas Water Development Board
Texas General Land Office
Railroad Commission of Texas
U.S. Environmental Protection Agency
U.S. Department of Agriculture
U.S. Geological Survey
U.S. Fish and Wildlife Service
Texas river authorities
Regional councils of government
County and municipal governments
Business, industry, and trade associations
Agricultural producers and associations
Educators, universities, and research organizations
Citizens and interest groups

Key Terms

There are a number of key terms and concepts that must be mastered in order to understand how the state manages water quality. Those key terms will be highlighted throughout this document in boxes like this one.

Water Quality—What Is It and How Is It Measured?

In order to protect water quality, we must define and measure it, identify the types and sources of pollution, and implement plans to protect or restore it. Under the federal Clean Water Act, Texas and other states must establish standards that describe how surface water bodies are used, and carry out a program to regularly monitor the status of water quality in relation to those standards. This document provides an overview of the standards and criteria the TCEQ uses to define and evaluate the quality of surface waters in Texas, and the programs and practices the state employs to protect and restore water quality.

What Causes Pollution?

Water pollution can arise from a variety of sources, including urban growth, suburban development, mining, industry, agriculture, and even natural sources such as wildlife populations or the effects of weather. The sources of water pollution fall into two main categories, called point and nonpoint sources.

Pollution from *point sources* can be traced to a specific location and point of discharge, such as a regulated industrial operation or a wastewater treatment facility. Pollution from most point sources is controlled through regulations that require treatment of a facility's wastewater before it is discharged into a nearby water body.

Nonpoint Source Pollution

Nonpoint source pollution originates from multiple locations, carried primarily by rainfall runoff.

Point Source Pollution

Point source pollution can be traced to a specific location, such as an industrial operation or a wastewater treatment facility.

Nonpoint source pollution comes from multiple locations, carried primarily by rainfall runoff. For example, pollutants may wash off lawns, construction areas, farms, or highways during a heavy rain, and then be carried to a nearby creek. Nonpoint source pollutants are more difficult to control because they often come from the everyday activities of many different people, such as fertilizing a lawn, using a pesticide, or constructing a new building on a small lot. Pollution may also originate from natural sources such as weather, erosion, and wildlife.

Most water bodies are affected by both point sources and nonpoint sources of pollution. For example, high levels of bacteria indicate that disease-causing microorganisms may be present in a water body. The bacteria may be originating from point sources, such as inadequately treated sewage or improperly managed animal waste from permitted livestock operations. Bacteria can also come from nonpoint sources, such as pet wastes, wildlife, aquatic birds, or failing septic systems.

A Watershed Approach

By looking at a *watershed*—the geographic area that drains to a common body of water—Texas can evaluate the sources of pollution that may be affecting water quality. This approach is used to identify water quality problems and issues, to establish statewide and local water quality priorities, to develop community-based solutions, and to cooperate with local stakeholders to implement those solutions. The watershed approach is based on four basic principles:

- geographic focus based on hydrology rather than political boundaries
- objectives for water quality based on scientific data
- coordinated priorities and integrated solutions
- diverse, well-integrated partnerships

Watershed

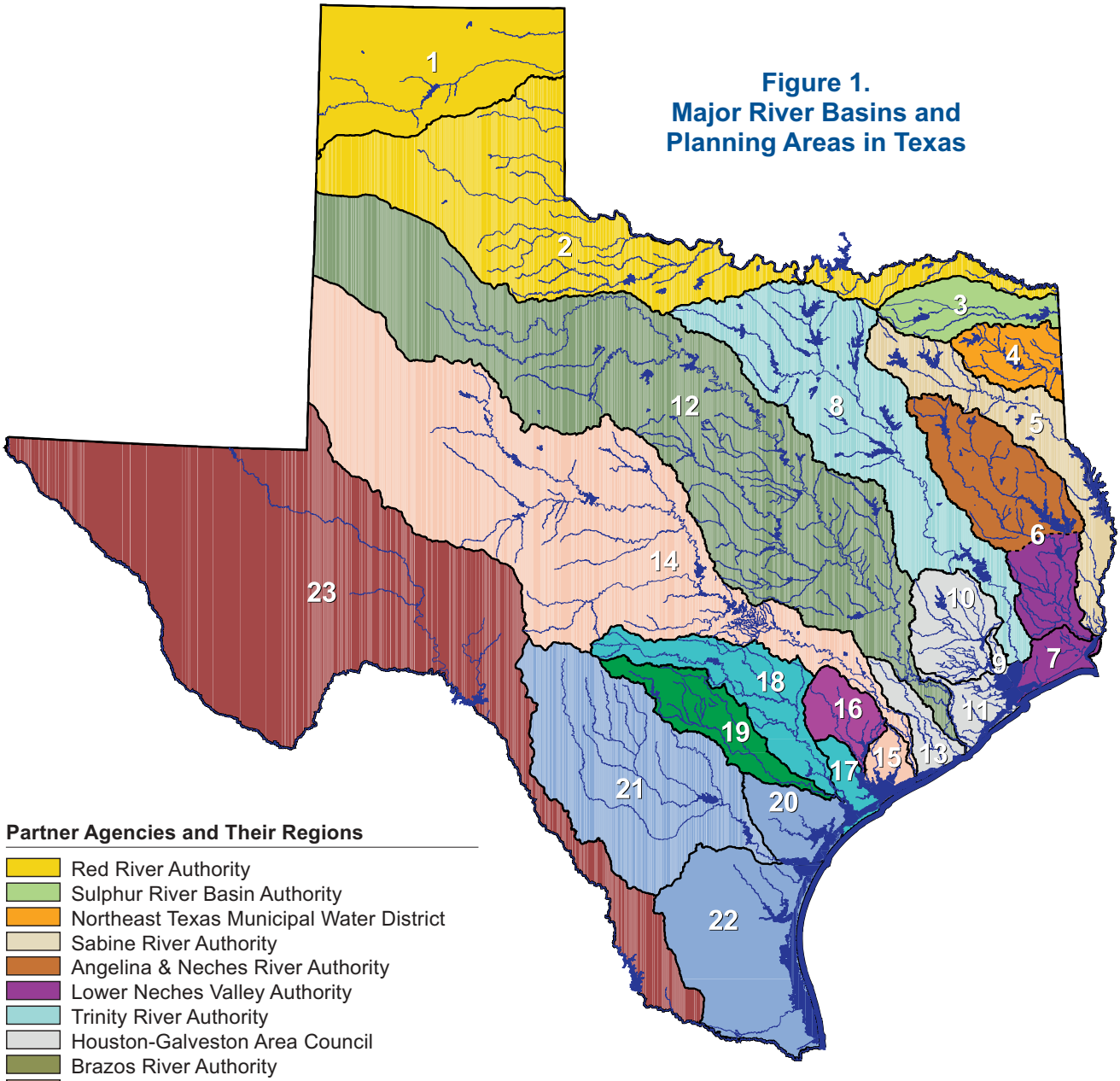
A watershed is a geographic area in which water, sediments, and dissolved materials drain into a common outlet. This outlet could be a stream, lake, playa, estuary, or ocean. Watersheds are also commonly called basins or drainage areas.

Everything that runs off or is discharged in a watershed can affect the quality of the receiving water body.

These principles guide all activities of the TCEQ's water quality programs. They provide the framework for coordinating people and activities to achieve the state's goals for clean water.

Protecting our lakes, bays, and streams is a complex process—not only in terms of the number of sources of pollution and the variety of water body types and interactions, but also in the number of people that must be involved. Using a watershed approach, we often find that problems seen at one point in a stream or lake are caused further upstream. With that in mind, we identify and remedy water quality problems at their source.

Figure 1.
Major River Basins and Planning Areas in Texas



Partner Agencies and Their Regions

- Red River Authority
- Sulphur River Basin Authority
- Northeast Texas Municipal Water District
- Sabine River Authority
- Angelina & Neches River Authority
- Lower Neches Valley Authority
- Trinity River Authority
- Houston-Galveston Area Council
- Brazos River Authority
- Lower Colorado River Authority
- Lavaca-Navidad River Authority
- Guadalupe-Blanco River Authority
- San Antonio River Authority
- Nueces River Authority
- International Boundary & Water Commission

River and Coastal Basins

1. Canadian River Basin
2. Red River Basin
3. Sulphur River Basin
4. Cypress Creek Basin
5. Sabine River Basin
6. Neches River Basin
7. Neches-Trinity Coastal Basin
8. Trinity River Basin
9. Trinity–San Jacinto Coastal Basin
10. San Jacinto River Basin
11. San Jacinto–Brazos Coastal Basin
12. Brazos River Basin
13. Brazos-Colorado Coastal Basin
14. Colorado River Basin
15. Colorado-Lavaca Coastal Basin
16. Lavaca River Basin
17. Lavaca-Guadalupe Coastal Basin
18. Guadalupe River Basin
19. San Antonio River Basin
20. San Antonio–Nueces Coastal Basin
21. Nueces River Basin
22. Nueces–Rio Grande Coastal Basin
23. Rio Grande Basin
24. Bays and Estuaries
25. Gulf of Mexico Jurisdictional Area

Managing Surface Water by Geographic Area

Texas uses the major watersheds—or river and coastal basins—of the state as the geographic units around which it builds its watershed approach to managing surface water quality.

Surface Waters

Surface waters in the state include lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, wetlands, marshes, inlets, canals, the Gulf of Mexico inside the territorial limits of the state, and all other bodies of surface water, natural or artificial, inland or coastal, fresh or salt, navigable or non-navigable. They include the beds and banks of all watercourses and bodies of surface water that are wholly or partially inside or bordering the state or subject to the jurisdiction of the state. Waters in treatment systems that are authorized by state or federal law, regulation, or permit, and that are created for the purpose of waste treatment are not included.

Classifying Waters by Geographic Area

Because of the vast extent of surface waters in Texas, and the ecological diversity of the state, the major rivers, lakes, and estuaries have been subdivided into areas called "classified segments." The classified segments are given numbers that correspond to the major river basin in which they are located.

For example, the Brazos River, one of the state's longest rivers, has been divided into 57 separate segments and its watershed is designated as Basin 12. Many lakes lie within the Brazos River Basin, and are also assigned segment numbers. All the segment numbers have four digits—the first two indicate the basin number, and the second two indicate the specific segment. For example, Segment 1210 is Lake Mexia in the Brazos River Basin; Segment 1427 is Onion Creek in the Colorado River Basin.

The areas of the classified segments are defined in the Texas Surface Water Quality Standards. Most of the perennial (always flowing) rivers in the state, and lakes and estuaries with large areas, are classified. Figure 1 shows the state's major river and coastal basins and the basin numbers assigned to them.

However, not all bodies of water in Texas are classified in the Standards. For example, when managing a classified segment of the Brazos River, it may be necessary to examine water quality in the tributaries that flow into that segment. Some of those tributaries may not be part of the system of classified segments. When that happens, for management purposes, the tributary is referred to as an *unclassified segment*. The unclassified tributary will be assigned a tracking number related to the classified segment in whose watershed it resides, along with a letter. For instance, unclassified tributaries of Onion Creek would be identified as Segments 1427A, 1427B, and so on.

Classified Segment

A water body or portion of a water body that is individually defined in the Texas Surface Water Quality Standards. A segment is intended to have relatively homogeneous chemical, physical, and hydrological characteristics. A segment provides a basic unit for assigning site-specific standards and for implementing the agency's programs to manage water quality. Classified segments may include streams, rivers, bays, estuaries, wetlands, lakes, or reservoirs.

The classified segments are assigned four-digit numbers. The first two digits correspond to the major basin in which they are located. The last two digits distinguish individual segments within the particular basin.

The same numbering system applies to unclassified lakes. Both classified and unclassified segments are referred to generically as *segments*. The term *water body* is used to refer to entire rivers, reservoirs, or estuaries.

The Water Quality Management Cycle

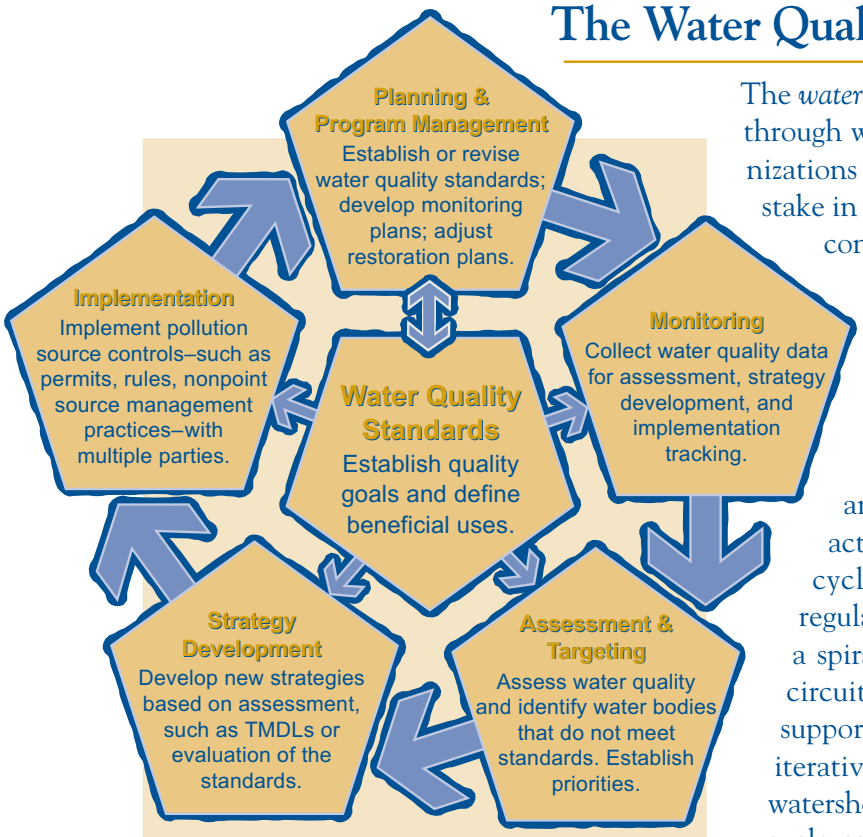


Figure 2.
Water Quality Management Cycle

The *water quality management cycle* is the process through which the state works with other organizations and with local residents who have a stake in water quality. This approach is used to continuously identify water quality problems, to establish statewide and local water quality priorities, to develop community-based solutions, and to collaborate with local stakeholders to implement those solutions.

Because environmental planning and implementation are rarely one-time activities, the water quality management cycle has five phases that are repeated regularly (Figure 2). Ultimately, the cycle is a spiral because at the completion of each circuit, water quality and the programs that support it are continuously improving. This iterative cycle reflects the dynamic nature of watershed management. Figure 2 illustrates this cycle and the major steps in the process of managing the quality of the state's surface waters.

Managing water quality through a watershed approach requires an ongoing cycle of tasks, driven by the water quality standards:

- **Planning and Program Management**—devising and adjusting plans and programs to protect and improve surface water quality;
- **Monitoring**—collecting data to monitor the condition of surface waters;
- **Assessment and Targeting**—assessing data to determine water quality status and to identify any impairments;
- **Developing Strategies**—for protecting, improving, or restoring water quality;
- **Implementing Pollution Controls**—for both point and nonpoint sources and evaluating progress, which may lead back to revising those plans or formulating new ones.

Water Quality Standards

Water quality standards are the foundation for managing surface water quality. A water quality standard is the combination of:

- a designated use and
- the criteria necessary to attain and maintain that use.

Standards define the goals for a body of water. The uses prescribe the purposes for which the water should be suitable. Five general categories of use are defined under the Texas Surface Water Quality Standards:

- aquatic life
- contact recreation
- public water supply
- fish consumption
- general uses

The criteria define the instream conditions necessary to support those uses. Criteria are either:

- numeric—a limit on the amount of a certain pollutant that a water body may contain; or
- narrative—a prohibition on a certain condition in the water, such as color, odor, or excessive turbidity.

Water quality standards are the basis for:

- evaluating monitoring data to see if water quality is being maintained,
- setting levels of treatment for permitted wastewater discharges, and
- establishing water quality targets to reduce pollutants in waters that do not meet standards.

Water Quality Standards

Water quality standards are the foundation for managing surface water quality. A standard consists of two parts:

- a use, or the purposes for which surface water will be used; and
- criteria, or the indicators that will be used to determine if the use is met.

Uses and criteria are paired to set the standards for water quality. For example, one use is a healthy environment for fish and other aquatic organisms. It is called the "aquatic life use" in the standards. Criteria used to determine whether the aquatic life use is met may include how much dissolved oxygen is present in the water and how diverse the population of aquatic organisms is.

The standards also define an antidegradation policy that protects existing uses and the state's highest quality waters. The complete Texas Surface Water Quality Standards are available in Title 30 of the Texas Administrative Code, Chapter 307.

The standards assign specific uses for most medium to large water bodies, and general uses for all water bodies. For example, Possum Kingdom Lake must meet requirements for the specific uses of public water supply, swimming and other recreation, and a high-quality environment for fish and other aquatic species. Each use defined in the standards is linked to measurements for specific conditions or pollutants. These measurements are used to evaluate whether water quality is sufficient to maintain its designated uses.

Other basic uses—such as navigation, agricultural water supply, and industrial water supply—are applicable to all waters in the state where they can be achieved. Some indicators of water quality, such as the narrative requirements in the general criteria, are intended to protect multiple uses and aesthetic conditions.

Aquatic Life

Standards associated with the *aquatic life use* are designed to protect plant and animal species that live in and around the water. Some pollutants or conditions that may result in harm to aquatic species include low levels of dissolved oxygen and the presence of toxic substances such as metals or pesticides in water. Because oxygen is necessary to support life, its concentration in water is an easy-to-measure characteristic that generally reflects the ability of a water body to support a healthy, diverse aquatic population. Other important indicators of suitability for the aquatic life use include concentrations of substances that can be toxic, such as certain metals—like selenium, mercury, and zinc—and toxic organic pollutants—such as pesticides and some industrial chemicals.

Contact Recreation

The standard associated with the *contact recreation use* is designed to ensure that water is safe for swimming or other water sports that involve direct contact with the water, especially with the possibility of ingesting it. High concentrations of certain bacteria in water indicate that there may be a risk of becoming ill from recreational activities. Though it is possible to swim in water that does not meet this standard without becoming ill, the probability of illness is higher.

Public Water Supply

Standards associated with the *public water supply* use indicate whether water from a lake or river is suitable for use as a source for a public water supply system. Source water is treated before it is delivered to consumers; a separate set of standards governs treated drinking water. Certain substances are good indicators of whether a surface water body is or is not suitable as a source for drinking water. These include the presence of high concentrations of pesticides, some metals, and dissolved minerals such as sulfate or chloride. Treatment to remove high levels of minerals from drinking water may be expensive. Too many dissolved minerals in drinking water may cause a disagreeable taste, even after it is treated by public water-supply organizations.

Fish Consumption

Standards associated with the *fish consumption use* are designed to protect people from eating fish or shellfish that may be contaminated. These standards identify levels at which certain toxic substances dissolved in water may accumulate in the tissue of aquatic species. In addition, fish tissue is examined for accumulated toxins to determine the risk to human health from consuming fish or shellfish. If a significant risk is identified, the Texas Department of State Health Services issues advisories for such water bodies that restrict or prohibit consumption of fish taken from them. The standards also specify limits on bacteria levels in marine waters to ensure that oysters or other shellfish are safe for public sale and consumption.

Planning and Program Management

The TCEQ carries out regular planning reviews every two to three years for the various programs that make up the overall water quality management plan. These planning reviews serve to continuously improve the TCEQ's management of water quality.

Every two years, after an assessment of the state's water bodies is completed, the TCEQ meets with partner agencies and other stakeholders to develop monitoring plans for the succeeding two years. These plans are continuously reviewed and updated; a major update is considered one year into the monitoring plan.

Every three years, the TCEQ reviews the water quality standards to determine if revisions are needed. Revisions are proposed based on scientific studies, and go through an extended peer review. All proposed revisions are put before the public for further review and comment before they are submitted to the USEPA for final approval.

Restoration plans and their progress are reviewed annually. Schedules and management activities are adjusted as needed, both for individual projects and for the programs as a whole.

Periodic administrative reviews ensure that the TCEQ's operating processes—such as issuing and renewing permits for wastewater discharges, assessing water quality, and developing restoration plans—are as efficient and cost-effective as possible while still protecting water quality.

Monitoring Conditions and Collecting Data

Data on water quality are gathered regularly to monitor the condition of the state's surface waters. For example, chemical, physical, biological, hydrological, hydraulic, and land-use data are collected by the TCEQ, the regional agencies of the Clean Rivers Program, and other organizations, such as other state and federal agencies, educational institutions, volunteer monitoring groups, and private organizations under contract to the state. Monitoring plans are guided by quality assurance project plans (QAPPs) to ensure that data are collected according to generally accepted practices and are of sufficient quality to be used in making scientific assessments and management decisions.

Texas collects data to monitor the status of water bodies for five main purposes:

- routine monitoring
- systematic monitoring
- targeted monitoring
- permit support monitoring
- effectiveness monitoring

Monitoring
Collecting data and information on hydrological conditions in water bodies.

Routine monitoring is designed to assess the status and trends of overall water quality throughout the state, and for each river basin. Data are regularly collected using a monitoring network of key sites on the major water bodies in each basin. Monitoring sites may also include smaller water bodies to support characterization of ecoregions, basin-specific conditions, or both.

Systematic monitoring focuses on evaluating subwatersheds and unclassified segments. Its purposes are to detect and investigate areas of concern and to isolate issues that require further study. It also includes monitoring at sites to check the status

of segments (identify improvements or concerns). This monitoring strategy rotates resources around the river basin to gather information on water bodies that would not normally be included in the routine monitoring program.

Targeted monitoring is conducted on segments for one or more of the following reasons: to investigate segments in which water quality might be threatened but is not yet impaired; to establish the extent and degree of an impairment; or to determine the best strategy for restoring water quality. Sometimes called special studies, targeted monitoring activities usually involve intensive periods of data collection at sites where routine or systematic monitoring identified impacts, concerns, or impaired uses.

Permit-support monitoring is used to address specific areas where additional information is needed to support the development of permits that allow wastewater discharges. This may include studies to gather site-specific information for use in developing permits.

Effectiveness monitoring is conducted to evaluate whether management practices, regulatory measures, and plans for watershed improvement and restoration are producing the desired results.

The **Clean Rivers Program** plays a key role in the TCEQ's yearly integration of these various monitoring needs into a coordinated monitoring schedule for the entire state. The schedule shows all surface water monitoring being conducted by the TCEQ or under its contracts or cooperative agreements for each planning year. It does not include monitoring of effluent discharges by wastewater permit holders; those discharges are reported to the TCEQ as a condition of the wastewater permits.

Planning and development of the coordinated monitoring schedule take place from January through May preceding the state fiscal year for which the plan is developed. To support coordinated monitoring, the TCEQ has developed guidance for selecting sites and for sampling methods for routine, systematic, and targeted monitoring. The coordinated monitoring schedule is hosted by the Lower Colorado River Authority, a Clean Rivers Program agency, at its web site, <http://cms.lcra.org/>.

Coordination of State and Regional Priorities

The TCEQ works in partnership with the Texas Clean Rivers Program to set regional priorities for protecting and improving the state's surface waters. The Clean Rivers Program brings together state, regional, and federal agencies to:

- eliminate duplication in monitoring surface water quality and thereby leverage resources;
- support data sharing and quality assurance by creating uniformity in methods;
- establish regional stakeholder forums to involve the public in identifying, prioritizing, and managing local water quality issues;
- set priorities and schedules for monitoring; and
- identify problems and preventive or remedial measures.

To support those objectives and the TCEQ's overall water quality management program, the long-term action plan is based on nine key methods:

- Ensure efficient use of public funds.
- Enhance public participation and outreach.

- Encourage comprehensive and cooperative watershed planning.
- Maintain basin-wide water quality monitoring programs.
- Develop and maintain a water quality database accessible to partner agencies.
- Provide quality-assured data to the TCEQ for use in decision making.
- Focus on higher priority issues and address local initiatives.
- Identify, analyze, and report on water quality issues and potential causes of pollution.
- Identify and evaluate alternatives for preventing and reducing pollution.

Through its activities, the Clean Rivers Program plays a vital role in ensuring clean, usable water supplies for Texas. The partner agencies for the CRP, and the regions for which they are responsible, are shown in Figure 1.

Assessment and Targeting

Every two years, the states must assess the quality of their water and submit a report to the USEPA detailing the extent to which each water body in the state meets water quality standards. The TCEQ publishes this biennial assessment on its web site as the *Texas Water Quality Inventory and 303(d) List*.

In the past, Texas published two different reports, often referred to as the 305(b) Report and 303(d) List, after the sections in the Clean Water Act that require the assessment. Since 2002, both reports have been published as one document, in accordance with guidance from the USEPA. The document still has essentially two main parts: the Inventory, which gives the status of all the waters in the state, and the 303(d) List, which identifies waters that do not meet one or more of the standards established to ensure the beneficial use of the segment.

Assessment
Evaluation of data and information against a set of standards or benchmarks.

The Inventory

The Inventory describes the status of all surface water bodies of the state that were evaluated for the given assessment period. The TCEQ uses data collected during the most recent five-year period in making its assessment. The data are gathered by many different organizations that all operate according to approved quality control guidelines and sample collection procedures. Water quality is dynamic and constantly changing, so the Inventory represents a snapshot of water quality conditions during the time period considered in the assessment.

The assessment guidance describes the methods the TCEQ uses to evaluate whether water bodies are meeting standards and criteria for surface water quality. These methods are developed by the TCEQ with the advice of a diverse group of stakeholders, and are made available to partner organizations and stakeholders every two years, prior to the biennial assessment in which they will be used.

The 303(d) List

The 303(d) List is an important management tool produced as part of the assessment. It identifies waters for which preventive measures have not been sufficient to achieve water quality standards. The 303(d) List is subject to review and approval by the USEPA.

When a segment is identified on the 303(d) list, certain new requirements may apply. Listing has immediate implications for facilities that discharge wastewater into the listed segment; most importantly, the TCEQ may not allow any new or expanded discharges of a listed pollutant into a listed segment if it would contribute to the impairment.

After listing, the TCEQ may develop a restoration plan, evaluate the appropriateness of the standard, or collect more data and information to determine what management steps are needed. After a restoration plan is developed, permits for the segment may be affected in the following ways.

- The TCEQ may initiate amendments to impose new limits, or may impose them with routine renewals or amendments.
- Permitted loading from existing facilities may be substantially reduced.
- New facilities may be required to meet more stringent effluent limits than expected.
- In some cases or areas, storm water permits may receive new or more stringent limits.
- Dischargers may no longer be eligible for general permits.
- Additional monitoring and reporting requirements may be added.

Implementation of nonpoint source management practices may also be required under restoration plans, such as:

- Management of runoff by such means as detention basins, filter strips, infiltration basins, porous pavement, retention ponds, and swales.
- Management of operations to decrease or eliminate pollutants in runoff, such as spill prevention and control, source controls, and education.

Categories Indicate Water Quality Status

The Inventory assigns each assessed segment to one of five categories to provide information to the public, the USEPA, and internal agency programs about water quality status and management activities (see Table 1, page 13). The categories indicate the status of the segment and how the TCEQ will approach identified water quality problems.

Impairment
The combination of one designated use with one pollutant or condition of concern.

Parameter
A pollutant or condition affecting a body of water; also, a criterion used to measure attainment of a particular use. Examples include low dissolved-oxygen concentrations, a particular metal such as zinc, or a particular pesticide such as DDT.

The higher the category number is, the more effort is required to manage water quality. For example, segments in Category 5 constitute the 303(d) List, and require remedial action by the state to restore water quality. For segments in Category 5a, the TCEQ must develop a scientific allocation called a *total maximum daily load* (TMDL) and a plan to implement it (these are discussed in more detail in the section "Restoring Water Quality"). Segments in Category 1 are meeting all their uses, and require routine monitoring and preventive action.

Total Maximum Daily Load (TMDL)

A TMDL:

- determines the maximum amount of a pollutant that a segment can receive and still both attain and maintain its water quality standards; and
- allocates this allowable amount (load) to point and nonpoint sources in the watershed.

Further, these categories must be applied to each combination of designated use and the *parameter* (pollutant or condition of concern) that determines support of beneficial uses. An *impairment* is the combination of the use that is not supported with the parameter of concern for an individual segment. For example, the concentration of dissolved oxygen is one of the criteria used to determine the support of the aquatic life use. If dissolved oxygen concentrations are too low, one impairment would exist for the segment under examination.

Since a water body has multiple uses, it may fall into different categories for different uses. In that case, the overall category for the segment is the one with the highest category number.

For example, Spring Creek, Segment 1008 in the San Jacinto River Basin, does not attain the contact recreation use (Category 5c) nor the aquatic life use (Category 5b). It attains the public water supply and general uses, and the fish consumption use has not been assessed. The designation for the entire segment is Category 5b, since that is the highest category associated with any one of its uses.

Table 1. Categories of Use Attainment in the Water Quality Inventory

CATEGORY	DESCRIPTION
Category 1	Attaining the water quality standard and no use is threatened.
Category 2	Attaining some of the designated uses, no use is threatened, and insufficient information (or none) is available to determine if the remaining uses are attained or threatened.
Category 3	Insufficient information (or none) is available to determine if any designated use is attained.
Category 4	The standard is not supported or is threatened for one or more designated uses but this does not require the development of a TMDL.
Category 4a	A TMDL has been completed and approved by USEPA.
Category 4b	Other pollution-control requirements are reasonably expected to result in the attainment of the water quality standard in the near future.
Category 4c	Nonsupport of the water quality standard is not caused by a pollutant.
Category 5	Category 5 is the 303(d) list. The segment does not meet applicable water quality standards or is threatened for one or more designated uses by one or more pollutants.
Category 5a	A TMDL is under way or scheduled, or will be scheduled.
Category 5b	A review of the water quality standards will be conducted before a TMDL is scheduled.
Category 5c	Additional data and information will be collected before a TMDL or review of the water quality standard is scheduled.

Scheduling Management Activities for Listed Waters

The amount of time it takes to address a listed segment varies greatly. In some cases, a segment may be addressed within one to three years of its listing; in other cases, several years may be needed.

Several factors influence the scheduling of management activities for all three categories (5a, 5b, and 5c) of the list, such as the number of successive years a segment has been on the list, scheduled permit renewals, or administrative demands. Available funding ultimately determines how many new restoration or management projects will be initiated annually.

Ranking Segments for TMDL Development

The TCEQ is committed to beginning development of TMDLs for all segments in Category 5a within 10 years of their initial listing. In compliance with the federal regulations, the TCEQ prepares a schedule after each Inventory and List is completed that identifies the TMDLs that will be initiated within the next two years.

The most important factor in determining the schedule is the priority ranking assigned to each impairment. Others factors include the availability of funding and additional data or information gathered since the listing and ranking. The TMDL schedule is submitted to the USEPA in April of even-numbered years along with the 303(d) List.

After the draft 303(d) List is compiled, the TCEQ assigns a rank of *high*, *medium*, *low*, or *underway* to each new impairment that is listed. This rank is used in determining the priority for developing TMDLs. The TCEQ may also choose to reassign rankings for Category 5a impairments from previous 303(d) lists if TMDL work has not yet begun.

The six most important factors in assigning the rank are:

- Whether the impaired use is a threat to human health, aquatic life, or both.
- The availability of data, information, and tools (such as models).
- The degree of local and regional support for implementing a TMDL.
- The relationship of a listed impairment to others.
- Proximity of impaired areas.
- What year the impairment was originally listed.

All six factors are taken into account in reaching a final rank for a particular listed impairment (Table 2). Comments about the ranking are accepted during the public review of the Inventory and List. Changes may be made to the ranking as a result of public comment.

Strategies for Protecting and Improving Water Quality

Texas uses several strategies to protect water quality, such as issuing permits for discharges to streams and lakes, or devising watershed protection plans with local stakeholders. When these protective strategies are not sufficient to keep water bodies clean enough to meet the standards for their uses, the state takes action to restore water quality.

At all times, the TCEQ is protecting water quality through various programs. Just the act of monitoring and assessing water quality is a form of protection, since it informs state officials and the public about the status of Texas rivers, lakes, and estuaries and

Table 2. Ranking the Priority for Development of TMDLs

Use impaired
Depending on the threat to human health or aquatic life from the impairment, segments are ranked from high to low if: (1) Both human health and aquatic life uses are impaired. (2) Only human health uses are impaired. (3) Only aquatic life uses are impaired.
Availability of data, information, and tools
Higher rank is assigned where one or more of these are available.
Local and regional support for a TMDL
The greater the support from stakeholders for taking action, the higher the rank.
Impairments are related
(1) For newly listed impairments, the existence of a completed TMDL or of one already under development for a related impairment in the same water body influences the ranking. (2) In the same water body, the more closely related a new impairment is to an existing one, the higher its rank. For example, if nutrients are newly listed for a segment that is already listed for dissolved oxygen, the nutrient listing will be given higher priority than it might otherwise receive. The rank for the dissolved oxygen impairment might also be revised.
Proximity
This considers whether segments with the same impairment are relatively near to each other geographically. Even though an impairment might have a lower priority in terms of other ranking criteria, it might ultimately be ranked higher due to its proximity to another impairment if it is in: (1) a different assessment unit within the same segment, (2) a different segment that is hydrologically connected to the first, and/or (3) the same watershed.
Year of listing
The earlier the impairment was listed, the higher the rank.

about water quality management needs. More water bodies are being assessed each year, leading to more timely identification of problems. But much more is being done continually—such as issuing permits that limit pollutant discharges to protect rivers, lakes, and bays, developing plans to protect sources of drinking water, and informing Texans about water quality issues.

Impaired Segment

A segment of a water body is called "impaired" if it does not meet one or more of the standards established for its use. For example, a segment may be designated as impaired for the aquatic life use if dissolved oxygen concentrations are chronically low.

The segment may be attaining all its other uses—as a source for drinking water, and as a safe place to fish or swim—but still be designated as impaired because *all* uses are not attained.

The TCEQ's pace and progress in addressing impairments on the 303(d) list has risen sharply since 2000. More TMDLs are being developed and implemented. As water quality standards are revised, analyses are conducted to determine whether the currently defined uses are attainable at specific sites. In addition, studies are underway to further improve the existing standards. More data are gathered each year to ensure that we have as sound a basis as possible for maintaining existing controls and establishing new ones. The TCEQ water quality programs strive at all times for accurate assessment and continual improvement of the tools and information used to manage water quality.

Permits to Protect Water Quality

The TCEQ issues permits that control discharges of wastewater into the surface waters of the state. Many types of discharges are regulated, such as the effluent from industries, domestic wastewater from city treatment facilities, discharges from certain agricultural operations, and the storm water that runs off urban areas. The TCEQ also establishes pretreatment requirements in permits for some wastewater treatment facilities that are publicly owned.

The owners and operators of these facilities, called "dischargers" or "permittees," are responsible for using the best technologies that are both available and practical to reduce pollutants in the effluent from their facilities. Many different kinds of pollutants are regulated by permit, including metals, pesticides, organic compounds, and treated human waste. Permit limits on the emission of pollutants into the air may also prevent water pollution, since pollutants in the air can settle into creeks and lakes. However, this issue is very complex, and scientists currently do not have a complete understanding of the extent to which air emissions affect water quality.

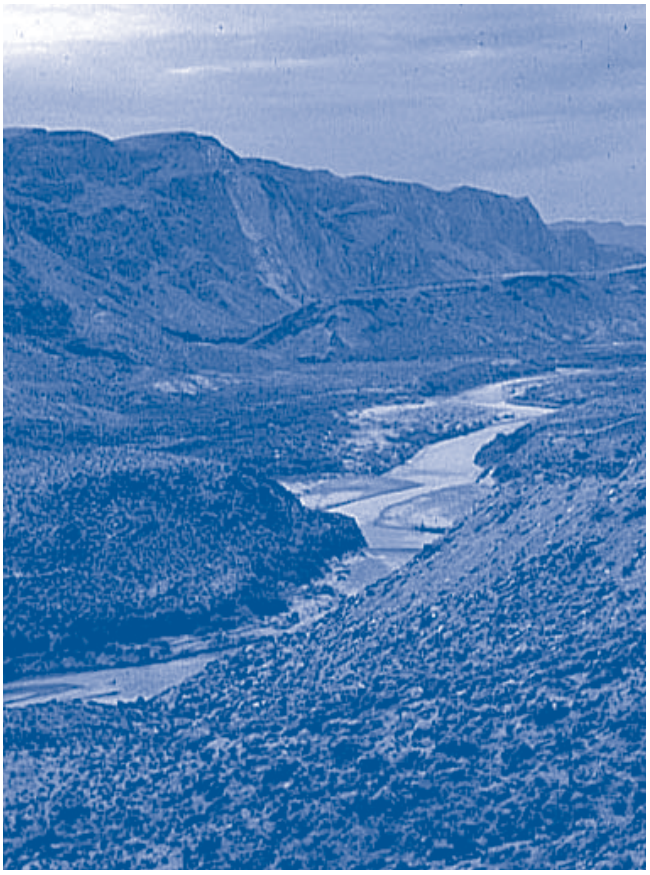
The TCEQ also works to protect water sources through permits that regulate the recycling, beneficial reuse, and disposal of sludge—the muddy solid waste produced during water and sewage treatment. Texas' federal and state requirements for wastewater and sludge permitting are codified in TCEQ rules.

The TCEQ's wastewater and sludge permitting activities are required under Section 402 of the federal Clean Water Act, and implemented federally through the National Pollutant Discharge Eliminations System. In 1998, the TCEQ was authorized by the USEPA to issue Section 402 permits on behalf of the federal government, with the exception of discharges associated with oil, gas, and geothermal exploration and development activities, which are regulated by the Railroad Commission of Texas.

The TCEQ combined its state-issued wastewater permits with the federal permits that were assumed by it under the Texas Pollutant Discharge Elimination System.

The TCEQ also protects wetlands and other surface waters through its certification of federal permits that regulate the discharge of dredge or fill material into the waters of Texas. The state's certification that federal dredge and fill activities will not degrade wetlands or other surface waters is required under Section 401 of the federal Clean Water Act. The U.S. Army Corps of Engineers issues permits for dredging and filling after certification by the TCEQ.

Protecting Stream Flows



Water availability is an issue in Texas due to the increasing difficulty of meeting the needs of people, industry, wildlife, and habitats. Across the state, naturally occurring periods of low water availability are exacerbated by the increases in human population and in activities that require water. According to the State Water Plan published by the TWDB, the total demand for water is expected to increase 18 percent from 2000 to 2050.

The availability of water in streams is an issue of quality as well as quantity. Insufficient water flows in streams can affect the quality of the aquatic environment, or can reduce a stream's capacity to assimilate wastewater discharges. It can also limit the flow of fresh water into downstream estuaries, which are dependent on fresh water for their ecological health and fisheries uses.

The TCEQ cooperates with the TPWD and the TWDB to collect instream flow data and analyze and evaluate the information to determine the flow conditions necessary to support a sound ecological environment.

The TCEQ also conducts environmental reviews of water rights applications to assess the possible impacts that granting a water right may have on fish and wildlife habitat, water quality, and the instream uses associated with the affected body of water. Possible impacts on bays and estuaries are also addressed for permits within 200 miles of the Gulf of Mexico.

The monitoring of stream flows and protection of instream uses is required and authorized under TCEQ rules, and by Texas statutes.

Protecting Sources of Drinking Water

The aquifers, lakes, and rivers that are designated by law for use as sources of drinking water are called source waters. The TCEQ protects *source waters* by:

- assessing their susceptibility to pollution, and
- helping local communities develop source water protection programs.

A report assessing the vulnerability of each source water is provided to the operators of systems that supply public drinking water. The assessments consider the location of pollutant sources, intrinsic characteristics, contaminant occurrence, well construction, geology, known point sources, and land uses within the capture zone of groundwater wells and within the watersheds of surface water intakes.

The assessments provide the scientific basis for the implementation of projects to protect source water. Water systems are encouraged to take an active role in verifying the completeness and accuracy of the data used in the assessment report.

Source water protection is a state program to prevent contamination of groundwater or surface water that is used as a source of public drinking water. Water suppliers implement local source water protection programs by working cooperatively with community members and by educating people about issues that affect their drinking water. All public water-supply systems may receive assistance in developing plans and implementation measures free of charge. Priorities for state assistance with plan development are set according to the results of the susceptibility assessments.

The protection and assessment of source waters are required and authorized under Section 1453 of the federal Safe Drinking Water Act.

Watershed Protection Plans

Watershed protection plans may be developed to protect high-quality waters, to address threatened waters before they become impaired, or to restore water bodies for which TMDLs are not practical. These plans are based on environmental targets, usually the applicable water quality standards. The types of goals and strategies that may be used in watershed protection plans are outlined in the USEPA's guidance for federal nonpoint source grants authorized under Section 319 of the Clean Water Act.

Watershed protection plans:

- describe the sources of pollution affecting a particular segment.
- define the voluntary actions that will be taken to reduce pollution or restore water quality.
- are developed in cooperation with regional and local stakeholders.

Watershed protection plans provide the opportunity to improve and protect water quality so that potential problems are addressed before the stream, lake, or bay actually fails to meet water quality standards.

Implementing Plans to Restore Water Quality

After a segment is listed in Category 5 [the 303(d) list], several different courses may be pursued to bring it into compliance with the standards. Further evaluation may be necessary to determine if the current standard is appropriate or to determine the cause of the impairment. The TCEQ may begin a project to reduce pollution and restore the

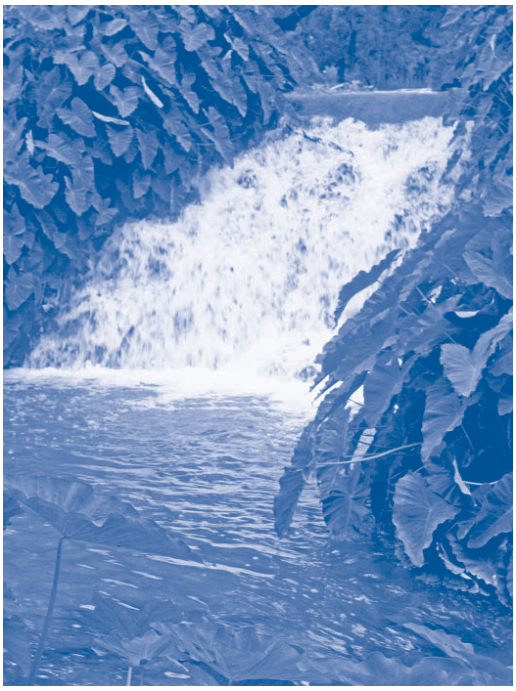
impaired use under its Total Maximum Daily Load Program or work with stakeholders to develop watershed protection plans. The TCEQ begins new projects to restore water quality with each new assessment, while continuing to complete and implement plans for waters listed in previous years.

For water bodies that are impaired due wholly or in part to nonpoint source pollution, federal grant funds provided under Section 319 of the Clean Water Act play a key role in implementing restoration projects. These grants provide support for management practices that improve the quality of impaired or threatened waters, and are often used to support development and implementation of TMDLs. NPS grants are also used to implement watershed action plans that are not associated with TMDLs; to conduct special projects that assess impacts due to NPS pollution; and to prevent the degradation of healthy rivers, lakes, and bays.

Analysis of Standards

Segments are placed in Category 5b if there is reason to believe that one or more of the assigned standards may be inappropriate because of local conditions. Waters in this category are slated for an review of their standards, called a *use attainability analysis*, or UAA.

For example, to determine appropriate aquatic life uses and related dissolved oxygen criteria, a UAA may consider aspects such as regularity of flow, habitat structure, typical water chemistry, and fish and other aquatic organisms that are characteristic in the area. Some rivers and lakes naturally support an abundant and diverse aquatic community, while other water bodies—such as small streams with intermittent flow—tend to have fewer types and total numbers of aquatic organisms. In addition, some water bodies might support a diverse aquatic community and fishery even though some components of their overall water quality are not superior under natural conditions.



Depending on the results of the UAA, uses or supporting criteria may be revised to be more or less stringent. Revisions of the standards are reviewed by the public, adopted by the Commission, and approved by the USEPA. When a review and any resulting revisions of the standard are completed, the segment may be moved to another subcategory of the 303(d) List, or to another category of the Inventory.

Targeted for Monitoring and Additional Assessment

Segments in Category 5c are targeted for additional monitoring and assessment. Segments may be placed in this category when there is insufficient information to determine the best course of action. The TCEQ and its monitoring partners collect the additional data and information needed to determine if a standards review is appropriate, if a TMDL should be scheduled, or (more rarely) to determine the degree and geographic extent of nonsupport. Depending on the results, the segment may be moved to another subcategory of the 303(d) List, to Category 4, or to Category 1 or 2 if standards are attained.

TMDLs and Implementation Plans

TMDLs and their implementation plans are developed to address segments listed in Category 5a. States must establish a TMDL for each impairment in each segment in Category 5a. The TCEQ then develops an implementation plan to achieve the loading allocations defined in the TMDL in cooperation with other governing agencies. TMDLs are subject to USEPA approval; implementation plans are not.

Total Maximum Daily Loads

In order to restore water quality, it is first necessary to be reasonably certain of the sources and causes of pollution. One way to accomplish this is to develop a scientific allocation called a *total maximum daily load*. A TMDL:

- determines the maximum amount of a pollutant that a segment can receive and still both attain and maintain its water quality standards; and
- allocates this allowable amount (load) to point and nonpoint sources in the watershed.

TMDLs must be submitted to the USEPA for review and approval. A TMDL is normally prepared for each pollutant in each impaired segment. This may mean that several TMDLs are developed for one river or lake. Generally, a TMDL should be completed within 13 years of the initial listing of a segment.

Implementation Plans

After a TMDL is completed, an *implementation plan* is developed that describes the regulatory and voluntary activities necessary to achieve the pollutant reductions identified in the TMDL. Management activities incorporate both non-regulatory and regulatory mechanisms, such as permit effluent limits and recommendations, nonpoint source pollution management practices, proposed revisions to stream standards, special projects, pollution prevention, public education, and watershed-specific rule recommendations. The best strategies for each individual watershed are developed in cooperation with regional and local stakeholders.

The implementation plan describes these various activities, the schedule for implementing them, and the legal authority for the regulatory measures. It also provides reasonable assurance that the voluntary practices will be undertaken. For instance, the plan may identify grant funds that have been secured to implement voluntary actions. The plan also includes the measurable results that will be achieved through the plan, along with a follow-up monitoring plan to determine its success. The ultimate goal is always the attainment of the water quality standard, but additional, interim results may be evaluated to assess progress toward that goal.

TMDL Implementation Plans and Watershed Protection Plans

Both I-Plans and WPPs have the same goal—improving water quality in rivers, lakes, or bays.

- How they differ:
  - I-Plans are remedial actions for impaired waters; WPPs may be either remedial or preventive.
  - I-Plans are based on TMDLs; WPPs use other environmental measures to meet goals for water quality.
- How they are alike:
  - They define actions needed to reduce pollution and restore water quality.
  - They are developed in cooperation with regional and local stakeholders.
  - They are based on the best available scientific methods and tools.

Even after plans are fully implemented, it is difficult to predict accurately how long it will take for improvements to occur in the stream, or how much improvement will be seen. For this reason, there is a schedule for phasing in implementation activities, especially those that address nonpoint sources of pollution. In more complex cases, less expensive, time-tested activities are implemented first, and their effects are assessed. If water quality standards are not yet achieved, then another set of regulatory or non-regulatory activities is implemented. Through this adaptive management approach, progress is assessed, and adjustments are made in the implementation activities as needed to attain water quality standards in the stream.

A Joint Effort—Stakeholder Involvement

Stakeholders are involved in each phase of the water quality management cycle through participation in standing and special committees.

The TCEQ is designated by law as the lead state agency for water quality in Texas. The Texas State Soil and Water Conservation Board also plays an important role as the lead agency in the state for the management of agricultural and silvicultural (forestry-related) nonpoint source runoff. The Texas Clean Rivers Program—a partnership of regional water management authorities—plays a key role in providing forums for stakeholder involvement and coordinating water quality management activities within specific river basins (see Figure 1).

Many other local, regional, state, and federal agencies have specific responsibilities that are critical to the restoration of polluted water bodies. Nongovernmental organizations, especially at the watershed level, can provide information about local concerns and infrastructure, and can help build support for the kind of pollution controls that may be required to restore water quality.

A coalition of government agencies and citizens is necessary to develop and implement water quality protection and restoration strategies. Public participation in watershed action plans and TMDL implementation plans:

- improves the quality and increases the quantity of information used as the basis for plans,
- promotes government accountability,
- ensures that state government considers the local perspective in its decisions,
- helps stakeholders gain insight into the nature of water quality problems and how alternate solutions affect their communities,
- leads to voluntary individual actions to curb pollution, and
- fosters local ownership of water quality.

Who Are Stakeholders?

Stakeholders include all individuals or organizations with an interest in the watershed that have one or more of these attributes:

- They are significant contributors of pollutant loadings or otherwise significantly impact water quality.
- They are significantly affected by water quality problems.
- They are directly affected by project outcomes or decisions.
- They may be required to undertake control measures because of statutory or regulatory requirements.
- They have statutory or regulatory responsibilities closely linked to water quality—for example, flood control.
- They can help develop or implement actions to remedy water quality problems.
- They live in the watershed or use the water resource.

Figure 3. Stakeholder Forums

Although not an exhaustive list of possible stakeholders, these categories give some examples of the kinds of groups and people who may become involved in protecting and restoring water resources:

- *Wastewater dischargers*—municipal and industrial.
- *Public*—individuals; civic groups such as those representing environmental, consumer, recreational, and community interests; schools and universities, and private landowners.
- *Agriculture and aquaculture*—corporate and individual farmers, ranchers, and producers; subsistence and commercial harvesters of fish and shellfish; agricultural groups and organizations.
- *Business*—commercial and industrial firms, utilities, business groups, and trade associations.

- *Government*—city, county, regional, state, federal, and international governmental agencies, tribes, utility districts, and river authorities.

Coordination of Stakeholders

Stakeholders are coordinated at three levels (see Figure 3).

- **Statewide** for agencies and organizations that manage water quality across the entire state, to target and synchronize their efforts.
- **Regionally** to assess conditions within a basin and establish basin-specific goals and priorities.
- **Locally** to develop watershed protection plans and TMDL implementation plans that have local support and input.

Clean Rivers Program Stakeholders Work Group

Composed of staff from the regional planning agencies of the Clean Rivers Program, the CRP Stakeholders Work Group represents stakeholder interests at the state level and coordinates with the TCEQ and other state agencies at annual meetings. See Figure 1 for a list of the CRP planning agencies and the regions they manage.

Basin Steering Committees

Basin steering committees of the Clean Rivers Program provide the primary forum for coordinating stakeholder involvement at the regional level. These committees carry out educational activities within the basin, such as workshops and volunteer programs. They also produce educational materials and conduct promotional campaigns through various media.

Local Watershed Work Groups

These work groups, composed of stakeholders in priority watersheds, provide valuable input about local conditions. They develop site-specific strategies for developing watershed protection plans or TMDL implementation plans.

Education

The TCEQ has numerous projects and programs to inform the public and their representatives about issues that affect water quality and ways individuals and regulated organizations can act to protect and improve the environment. These programs range from technical assistance for business owners to ad campaigns to formation of stakeholder groups that advise the agency.

Education is integrated into most water quality programs at the TCEQ. Educational activities may include presentations to stakeholder groups, forums to share pollution reduction technologies, public awareness campaigns, or distribution of educational materials to schools and volunteer groups.

A TCEQ public education campaign—Please Don't Feed the Storm Drain—provides information and materials that citizens of Texas can use to reduce nonpoint source pollution by changing their daily activities. TCEQ staff work with city, state, and government organizations, as well as nonprofits and corporate sponsors, to promote the campaign throughout the state.

Gauging Success

The success of the state's water quality management program is gauged by progress made toward protecting or restoring water quality uses that benefit wildlife, people, and the environment. Some of the reports of success that the TCEQ produces:

- progress toward environmental measures and program activities for the Texas Legislative Budget Board
- biennial reports to the Texas Legislature
- biennial and annual reports of TMDL implementation and nonpoint source management activities, respectively
- the Texas Water Quality Inventory and 303(d) List

These reports and other information about the TCEQ's water quality programs are available on the web at <www.tceq.state.tx.us>.

Making successful management decisions depends on understanding the relationships among water quality, water use, and conditions within a watershed. With the watershed approach, Texas integrates policy, science, and people to ensure clean water for years to come.

For More Information

Visit the TCEQ's web site at <www.tceq.state.tx.us/nav/eq/eq_water.html> for more information about managing the state's water quality. For specific information about this publication, contact the Chief Engineer's Office at 512/239-4900.

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