CHAPTER 3 TEXAS' WATERSHED APPROACH

The watershed approach described in this chapter provides an overview of Texas' management strategy for surface water quality. Some of the topics in this chapter are covered in more detail in other parts of this document.

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 the water bodies are used, and carry out a program to regularly monitor the status of water quality against those standards. 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 surface water bodies clean enough to be used in ways that meet the standards for them, the state takes action to restore water quality.

A WATERSHED APPROACH

By looking at a *watershed*—the geographic area that drains to a common body of water—Texas can evaluate all 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:

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 is done in a watershed can affect the quality of the receiving water body.

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

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

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 this in mind, we identify and remedy water quality problems at their source.

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 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. This includes the beds and banks of all water-courses and bodies of surface water that are wholly or partially inside or bordering the state or subject to the jurisdiction of the state; except that 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 considered to be water in the state.

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 and assigned tracking numbers, 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 designated as Basin 12. Many lakes also lie within the Brazos River basin, and are given 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 3.1 shows the state's major rivers 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—which are part of the segment's watershed. Some of these tributaries may not be part of the classified segment system. When that happens, for management purposes, the tributary is assigned a tracking number, which is referred to as an *unclassified segment*.

This unclassified tributary will be assigned the number of the classified segment in whose watershed it resides, along with a letter. For instance, Segments 1806A, 1806B, and so on. 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.

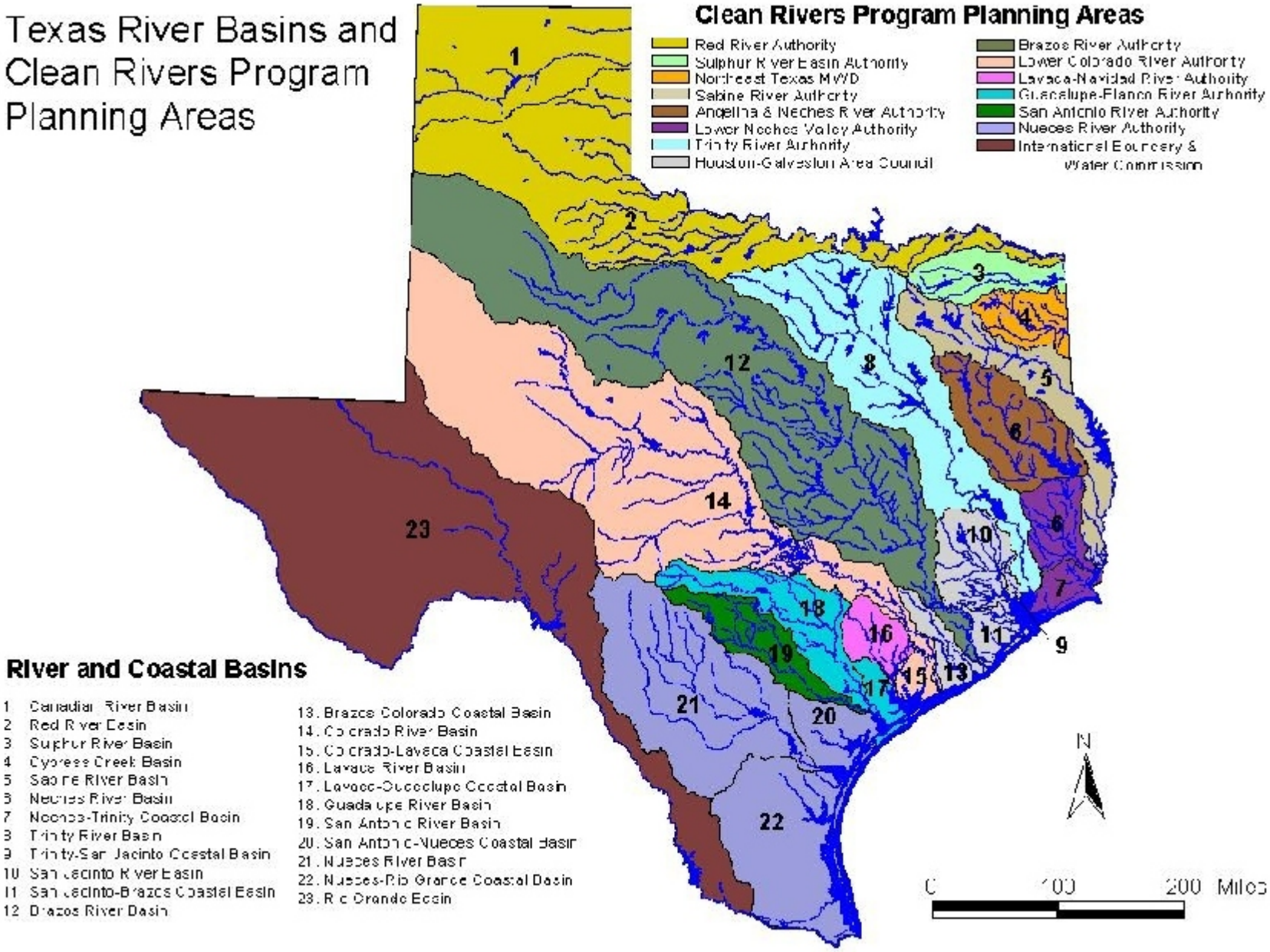

Figure 3.1 Major River Basins and Planning Areas in Texas

The 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.

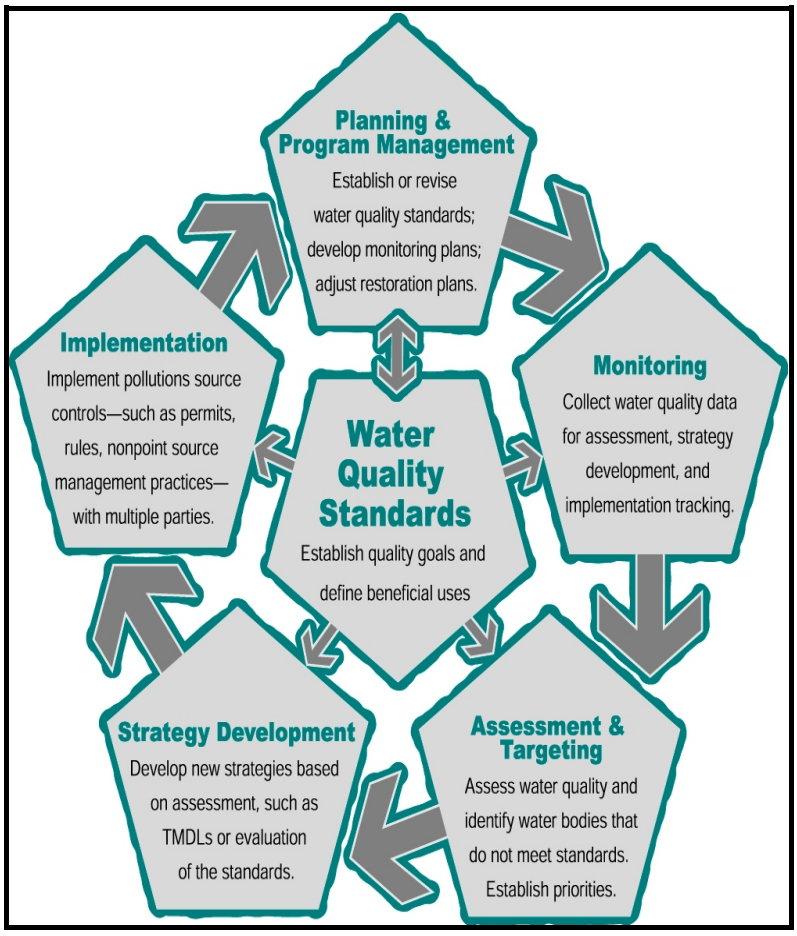

Figure 3.2. The Water Quality Management Cycle

Because environmental planning and implementation are rarely one-time activities, the water quality management cycle has five phases that are repeated regularly (Figure 3.2). This iterative cycle reflects the dynamic nature of watershed management.

A successful management framework must be flexible enough to accommodate this dynamic nature in an orderly manner over time.

Figure 3.2 demonstrates the dynamic nature of 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:

- **Standards and Planning**: setting standards for surface water quality and revising or formulating monitoring plans;
- **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 with pollutant source controls and practices; and
- **Implementing Pollution Controls**: for both point and non-point sources and evaluating progress, which may lead back to revising those plans or formulating new ones.

Standards and Planning

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 fit—such as recreation, support of aquatic life, or drinking water supply.

Five general categories for water use are defined under the Texas Surface Water Quality Standards:

- aquatic life use
- 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 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 set total maximum daily loads of pollutants.

Some standards are applied generally to many different water bodies, while some are site-specific. Any one water body will usually have multiple uses designated for it. For example, a lake or stream may be designated for use as a source of drinking, for recreation, and as a healthy environment for fish and other aquatic organisms.

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 (TAC), Chapter 307.

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 habitat 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, how much water flows through a stream and how deep it is, and how diverse the population of aquatic organisms.

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 good enough to maintain its designated uses.

Other basic uses — such as navigation, agricultural water supply, and industrial water supply — are applicable to all water 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 or 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 some 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 becoming ill 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 your tap; a separate set of standards governs treated drinking water. Indicators used to measure the safety or usability of surface water bodies as a source for drinking water include the presence or high concentrations of substances such as pesticides or some metals. Concentrations of dissolved minerals, such as sulfate or chloride, are also measured, since 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, odor or color, 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 significant risk is identified, the Texas Department of Health issues advisories for such water bodies that restrict or limit 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.

Monitoring

Water quality data 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 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)

that 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 conducts five main types of data collection to monitor the status of water bodies:

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

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

Systematic monitoring focuses on evaluating subwatersheds and unclassified water bodies. Its purpose is to investigate and detect areas of concern, and isolate issues that require further study. It also includes monitoring at sites to check the status of water bodies (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 water bodies where there is reason to believe there is a threat or a concern for water quality, 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 need 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 watershed improvement and restoration plans are producing the desired results.

The CRP 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 coordination of monitoring by wastewater dischargers that is reported to the state as a condition of their permits.

Planning and development of the coordinated monitoring schedule takes 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 CRP agency, on its Web site at *http://cms.lcra.org/*.

Coordination of State and Regional Priorities

The TCEQ works in partnership with the Texas Clean Rivers Program (CRP) to set regional priorities for protecting and improving the state's surface waters. The CRP 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 goals and the TCEQ's overall water quality management program, the CRP's long-term action includes 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 river basin water quality database clearinghouse.
- Provide quality-assured data to the TCEQ for use in water quality decision-making.
- Focus on 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 CRP plays a vital role in ensuring clean, useable water supplies for Texas. The partner agencies for the CRP, and the regions for which they are responsible, are shown in Figure 3.1.

Assessment and Targeting

Every two years, the states must assess the quality of their water and target those water bodies for which additional data collection or restoration efforts are required. This information is submitted to the U.S. Environmental Protection Agency (EPA) in a report that details the extent to which each water body in the state meets water quality standards. The TCEQ publishes this biennial assessment as the *Texas Water Quality Inventory and 303(d) List*.

Assessment is the evaluation of data and information against a set of standards or benchmarks.

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 describe the requirements of the assessment. Since 2002, both reports have been published as one document, in accordance with guidance from the EPA. 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 water body.

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. The quality of waters described in the Inventory represents a snapshot of conditions during the time period considered in the assessment. Water quality is dynamic and constantly changing.

The assessment guidance is based on a set of methods that apply the surface water quality standards and criteria. 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 EPA.

When a water body is identified on the 303(d) list, certain new requirements may apply for facilities that discharge wastewater into the listed water body. Importantly, the TCEQ may not allow any new or expanded discharges of a listed pollutant into a Category 5 water body if it contributes to the impairment. Other possible effects on permits that may result from a restoration plan for the water body include:

- 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.

Additional nonpoint source management practices may also be required, 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 water body to one of five categories to provide information to the public, the EPA, and internal agency programs about water quality status and management activities (see Table 1). The categories indicate the status of the water body, and how the state will approach identified water quality problems.

Higher category numbers correspond to higher levels of effort required to manage water quality. For example, water bodies in Category 5 constitute the 303(d) List, and require remedial action by the state to restore water

quality. For water bodies in Category 5a, the state must develop a scientific model 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"). Water bodies in Category 1 are meeting all their uses, and require routine monitoring and preventive action.

Table 3.1 Categories of Use Attainment in the Water Quality Inventory

Category 1	Attaining all water quality standard and no use is threatened.
Category 2	Attaining some of the designated uses; no use is threatened; and insufficient or no data and information are available to determine if the remaining uses are attained or threatened.
Category 3	Insufficient or no data and information to determine if any designated use is attained.
Category 4	Standard is not supported or is threatened for one or more designated uses but does not require the development of a TMDL.
Category 4a	TMDL has been completed and approved by EPA.
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 water body 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 underway, 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.

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.

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. The combination of the use with the parameter is called an *impairment*. 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 water body 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 water body is the one with the highest category number.

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

Ranking Category 5a Segments

After the draft 303(d) List is compiled, the TCEQ assigns a rank of High, Medium or Low to each impairment (see Table 3.1) of Category 5a segments. This rank is used in determining the priority for implementing TMDLs. The rank is based on criteria such as the degree to which the water quality standard is exceeded, and the level of public concern (as judged, in part, by the interest of local groups). Comments are accepted during the public review period and changes may be made as a result of public comment.

Factors considered in the ranking include:

- whether the impairment affects human health
- proximity of one impaired segment to others that have similar or related pollutants
- local and regional support for TMDL development
- data availability for immediate TMDL development
- similarity of the strategies and actions needed to address impairments

The specific criteria and point system used for scheduling waters for TMDL development is shown in Table 3.1.

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.

Schedule 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 Water Quality Inventory 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 additional data or information gathered since the listing and ranking, and the availability of funding. The TMDL schedule is submitted to the EPA in April of even-numbered years along with the 303(d) List.

Table 3.2 Criteria for Prioritizing TMDLs (Category 5a Waters) for Development

1. The pollutant causing the impairment is a:	**Points**
A. Threat to human health *Includes nonsupport of the following uses: public water supply, contact recreation, fish consumption, oyster waters*.	50
B. Threat to aquatic life *Includes nonsupport of the following uses: aquatic life, general, and narrative criteria*	30
C. Threat to both human health and aquatic life	30
2. Watershed proximity, related pollutants, and the ease of incorporating a newly identified parameter of nonsupport into an existing project.	**Points**
A. Ongoing TMDL in the same segment for a different pollutant	10
B. Ongoing TMDL in the same segment watershed for the same pollutant	20
C. Ongoing TMDL in the same segment watershed for a different pollutant	10
D. Ongoing TMDL in a contiguous watershed for the same pollutant	10
E. No ongoing TMDL in the same segment or contiguous watershed	0
3. Data availability for TMDL development	**Points**
A. Ongoing modeling activities in the segment	10
B. Recent targeted data collection activities within the segment, other than routine monitoring	10
C. TMDL tools still in development (for example, bacteria source tracking, mercury)	-30
4. Local and regional support for TMDL development	**Points**
A. River Authority and/or Council of Government active in current or recent TMDL project	20
B. TSSWCB or other state agency active in current or recent project	20
C. Dedicated regional staff are available in TCEQ region of the project	10
D. Positive stakeholder interest within the segment watershed	10

E. Strong opposition to the project	-10
5. Year of listing: under the commitment by TCEQ leadership in 1997 to begin development of TMDLs within 10 years of listing, water bodies listed earlier have a higher priority. If original listing year is:	**Points**
A. 1998	50
B. 2000	40
C. 2002	30
D. 2004	20
E. 2006	10
6. Best available funding information, with first priority given to ongoing projects. If project status is:	**Points**
A. ≥ 50% complete	50
B. < 50% complete	20
C. New project	0

Total Points	Priority
< 80	Low
90-160	Medium
> 160	High

Strategies for Protecting and Improving 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 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 on a regular basis—such as issuing permits that limit pollutant discharges to protect rivers, lakes, and bays, developing plans to protect sources of drinking water, and educating people about water quality issues.

The TCEQ's pace and progress in addressing impairments on the 303(d) list has risen sharply over the past five years. More TMDLs are being developed and implemented. The water quality standards were revised in 2000, and numerous analyses are being conducted to determine whether the currently defined uses are attainable at specific sites. In addition, other 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 establishing existing and new controls. The TCEQ water quality programs strive at all times to provide accurate assessment, and to

continually improve 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 plants, discharges from certain agricultural operations, and the storm water that runs off urban areas. The TCEQ also requires pretreatment permits for some wastewater treatment plants 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 good understanding of how to control water pollution from air deposition.

The TCEQ works to conserve potable water sources through permits that regulate the recycling, beneficial reuse, and disposal of sludge. Sludge is the muddy solid waste produced during the water and sewage treatment processes. Texas' federal and state requirements for wastewater and sludge permitting are codified in the Texas Administrative Code.

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 dredge and fill permits after certification by the TCEQ.

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 EPA 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 delegated to it under the Texas Pollutant Discharge Elimination System.

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 flows 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 collection 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 of granting of a water right on fish and wildlife habitat, water quality and the instream uses associated with the affected body of water. Possible impacts to bays and estuaries are also addressed for those 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 House and Senate bills.

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.
- assisting local communities to 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 that occur 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 source water protection projects. Water systems are encouraged to take an

active role in verifying the completeness and accuracy of the data used in the assessment report.

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

Source water protection is a program to prevent contamination of groundwater or surface water that is used as a source of public drinking water. Water suppliers implement 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 is 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 planned or developed. These plans are still based on environmental targets, usually maintaining the applicable water quality standards. The types of goals and strategies that may be used in watershed protection plans are outlined in the EPA'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 water body.
- define the actions needed to reduce pollution or restore water quality, both regulatory and voluntary.
- 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 water body 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 (TMDL) Program. The TCEQ undertakes 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 (NPS) 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 protection 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.

Standards Analysis

Water bodies 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 that are not due to human impacts. Waters in this category are slated for an analysis 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 and/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 EPA. When a review and any resulting revisions of the standard are completed, the water body may be moved to another subcategory of the 303(d) List, or to another category of the Inventory.

Targeted for Monitoring and Additional Assessment

Water bodies in Category 5c are targeted for additional monitoring and assessment. Water bodies 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 water body may be moved to another subcategory of the 303(d) List, or to Category 1 or 2.

TMDLs and Implementation Plans

TMDLs and their implementation plans are developed to address water bodies listed in Category 5a. States must establish a TMDL for each impairment in each water body in Category 5a. This may mean that several TMDLs may be developed for one river or lake. A TMDL must also allocate this load to the point and nonpoint sources of pollution in the watershed. The state must then develop an implementation plan to achieve the loading allocations defined in the TMDL. TMDLs are subject to EPA 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 model called a *total maximum daily load* (TMDL).

TMDL Implementation Plans (IPs) and Watershed Protection Plans (WPPs)

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

- How they differ:
  - ✓ IPs are remedial actions for impaired waters; WPPs may be either remedial or preventive.
  - ✓ IPs are based on total maximum daily loads; WPPs use other measurable environmental goals for water quality.
- How they are alike:
  - ✓ Define actions needed to reduce pollution and restore water quality.
  - ✓ Include both regulatory and voluntary actions.
  - ✓ Are developed in cooperation with regional and local stakeholders.
  - ✓ Are based on the best available scientific methods and tools.

A TMDL:

- determines the maximum amount of a pollutant that a water body 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 Environmental Protection Agency (EPA) for review and approval. A TMDL is normally prepared for each pollutant in each impaired water body. In general, a TMDL should be completed within 13 years of the initial listing of a water body.

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 nonregulatory and regulatory mechanisms, such as permit effluent limits and recommendations, nonpoint source pollution management practices, stream standard revisions, 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.

Even after plans are fully implemented, it is difficult to accurately predict 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 non-point sources of pollution. Less expensive, time-tested activities are implemented first, and their impacts are assessed. If water quality standards are not yet achieved, then another set of regulatory and/or nonregulatory activities is implemented. Through this adaptive management approach, the water body is reassessed, 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 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 (TSSWCB) also plays an important role as the lead agency in the state for the management of agricultural and silvicultural (forestry) 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 (see Figure 3.1 - Major River Basins and Planning Areas in Texas).

Many other local, regional, state, and federal agencies have specific responsibilities that are critical to the restoration of polluted water bodies. Nongovernment 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 protection plans and TMDL implementation plans provides the following benefits:

- 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 alternate solutions in their communities,
- leads to voluntary individual actions to curb pollution, and
- local ownership of water quality.

Who Are Stakeholders?

Stakeholders include all individuals or organizations in the watershed who have one or more of these attributes:

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

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:

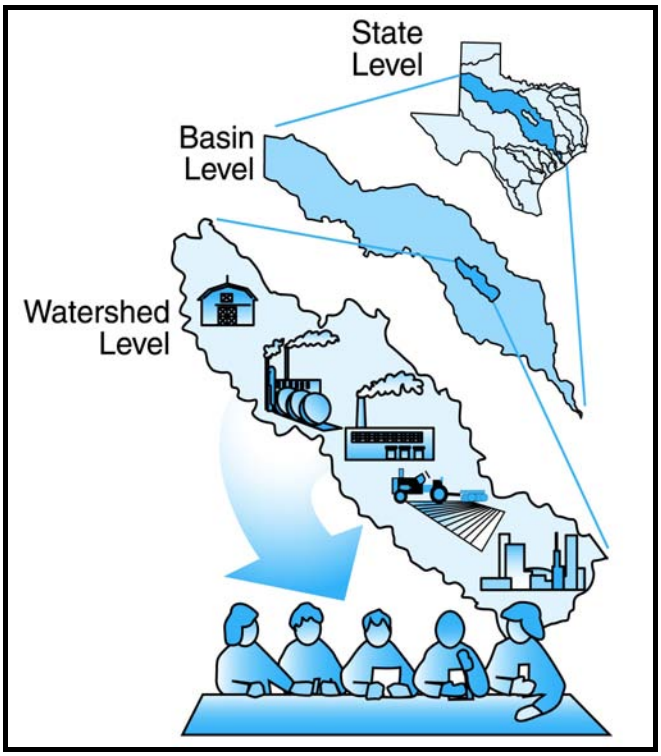

Figure 3.3 Stakeholder Forums

- Wastewater dischargers–municipal and industrial.
- Public–individuals; civic groups such as those representing environmental, consumer, recreational, and community interests; schools, 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, residential, and industrial firms; utilities, business groups, and trade associations.
- Government–city, county, regional, state, federal, and international government agencies, tribes, utility districts, and river authorities.

Coordination of Stakeholders

Coordination of stakeholders takes place at three levels (see Figure 3.3 - Stakeholder Forums):

- **statewide** for agencies and organizations that conduct water quality management activities 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

Comprised of staff from the regional planning agencies of the Clean Rivers Program (CRP), the work group represents stakeholder interests at the state level. The CRP Stakeholders Work Group 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 public information products and conduct promotional campaigns through various media.

Local Watershed Work Groups

These work groups, comprised of key 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 to business owners to ad campaigns to formation of stakeholder groups to 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.

GAUGING SUCCESS

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 is charged with producing include:

- progress report on environmental and program goals for the Texas Legislative Budget Board
- biennial reports to the Texas Legislature

- annual reports of TMDL implementation and nonpoint source management activities
- the Texas Water Quality Inventory and 303(d) List.

With the exception of the report to the Legislative Budget Board, these documents are available on the TCEQ's Web site 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.