Nonpoint Source Pollution Management in Texas

2017 ANNUAL REPORT

Texas Commission on Environmental Quality

Texas State Soil & Water Conservation Board

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2017 ANNUAL REPORT

LETTER

The *Nonpoint Source Management Program* outlines Texas' comprehensive strategy to protect and restore waters across the state impacted by nonpoint source pollution. This strategy is implemented by utilizing voluntary, regulatory, financial, and technical assistance approaches, while working with a multitude of partners, to achieve a balanced program. The United States Environmental Protection Agency (EPA) provides grant funding to Texas to implement the components and goals set forth in the *Texas Nonpoint Source Management Program*. The responsibility for implementing this program is shared between the Texas Commission on Environmental Quality (TCEQ) and the Texas State Soil and Water Conservation Board (TSSWCB).

Texas has consistently worked with partners across the state to develop and implement watershed-based plans to improve water quality. At the close of fiscal year 2017, 19 watershed protection plans had been accepted by EPA, and more than 17 others are under development across the state. Together with partners and stakeholders, the TCEQ and the TSSWCB are actively engaged in implementing voluntary management measures identified in the watershed-based plans.

In fiscal year 2017, the state updated the *Texas Nonpoint Source Management Program*, which was last approved by the EPA in 2012. Significant events have occurred since 2012 including implementation of the watershed action planning process to address water quality issues; rapid growth in the development and implementation of watershed protection plans that restore water quality; enhanced coordination of the Clean Water Act Section 303(d) Vision between the Nonpoint Source and Total Maximum Daily Load programs; and substantial progress between the TCEQ and the Texas General Land Office in moving the state closer to full approval of the Texas Coastal Nonpoint Source Pollution Control Program. The state is updating the program to incorporate these initiatives and to specify program goals for the upcoming five-year planning period.

We are pleased to present the *2017 Annual Report* of the state's *Nonpoint Source Management Program*. The report highlights our accomplishments in managing nonpoint source pollution and meeting the goals of the program. In partnership with the EPA and other federal, state, regional, and local watershed stakeholders, the TCEQ and the TSSWCB look forward to the continued implementation of an efficient, accountable, and transparent program.

Sincerely,

Rex Isom
Executive Director
Texas State Soil and
Water Conservation Board

Richard A. Hyde, P.E.
Executive Director
Texas Commission on
Environmental Quality

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Introduction

CHAPTER 1

Nonpoint source pollution occurs when rainfall or snowmelt flows over land, roads, buildings, and other features of the landscape, and carries pollutants into drainage ditches, lakes, rivers, wetlands, coastal waters, and even underground sources of water.

Defining Nonpoint Source Pollution

Nonpoint source pollution occurs when rainfall or snowmelt flows over land, roads, buildings, and other features of the landscape, and carries pollutants into drainage ditches, lakes, rivers, wetlands, coastal waters, and even underground sources of water.

This is unlike point source pollution which results from a discharge at a specific single location. Nonpoint source pollution also includes the flow of water from sources such as leaking on-site sewage facilities, commonly known as septic systems. Some nonpoint source pollutants include:

- fertilizers, herbicides, and insecticides from agricultural lands and residential areas;
- oil, grease, and toxic chemicals from spills, roads, urban areas, industrial facilities, and energy production;
- sediment from construction sites, crop and forest lands, and eroding stream banks;
- bacteria and nutrients from livestock, pet waste, and leaking septic systems.

Nonpoint source pollution can also originate as air pollution which is deposited onto the ground and into waterways, through a process called atmospheric deposition. Changes in the flow of waterways due to dams and other hydrologic modifications can also cause nonpoint source pollution.

What Guides Nonpoint Source Pollution Management in Texas?

Under the federal Clean Water Act (CWA), Texas must adopt surface water quality standards for waters in the state, assess the status of water quality, and implement actions necessary to achieve and maintain those standards. The long-term goal of the *Texas Nonpoint Source Management Program* is to protect and restore the quality of the state's water resources from the adverse effects of nonpoint source pollution. This is accomplished through cooperative implementation using the organizational tools and strategies defined below.

Partnerships

The Texas Commission on Environmental Quality (TCEQ) is the lead state agency responsible for establishing the level of water quality to be maintained in Texas. Primary responsibilities of the TCEQ include the issuance of permits for point source discharges and abatement of nonpoint source pollution from sources which are not agricultural or silvicultural. The Texas State Soil and Water Conservation Board (TSSWCB) is the lead agency in the state for planning, implementing, and managing programs and practices that prevent and abate agricultural and silvicultural nonpoint source pollution. The TCEQ and the TSSWCB coordinate closely to jointly administer the *Texas Nonpoint Source Management Program*.

Management of nonpoint source pollution in Texas involves partnerships with many organizations to coordinate, develop, and implement the *Texas Nonpoint Source Management Program*. With the extent and variety of nonpoint source issues across Texas, cooperation across political boundaries is essential. Many local, regional, and state agencies play an integral part in managing nonpoint source pollution. They provide information about local concerns and infrastructure and build support for the management measures that are necessary to prevent and reduce nonpoint source pollution. By coordinating with these partners to share information and resources, the state can more effectively manage its water quality protection and restoration efforts.

The Texas Nonpoint Source Management Program

The *Texas Nonpoint Source Management Program* outlines Texas' comprehensive strategy to protect and restore waters impacted by nonpoint source pollution. Nonpoint source pollution is managed through assessment, planning, implementation, and education. The state has established long- and short-term goals and objectives for guiding and tracking the progress of its nonpoint source management program. This report highlights the success in achieving these goals and objectives.

Goals for Nonpoint Source Management

Long-Term Goal

The long-term goal of the *Texas Nonpoint Source Management Program* is to protect and restore water quality affected by nonpoint source pollution through implementing the following short-term goals: data collection and assessment, implementation, and education.

Short-Term Goals

Goal One—Data Collection and Assessment

Coordinate with appropriate federal, state, regional, and local entities, and stakeholder groups to target water quality assessment activities in high priority, nonpoint source-impacted watersheds, vulnerable and impacted aquifers , or areas where additional information is needed.

Goal Two—Implementation

Implement Total Maximum Daily Load (TMDL) implementation plans and/or watershed protection plans and other state, regional, and local plans to reduce nonpoint source pollution by targeting activities in the affected areas identified as impacted or potentially degraded by nonpoint source pollution with respect to use criteria.

Goal Three—Education

Conduct education and technology transfer activities to increase awareness of nonpoint source pollution and activities that contribute to the degradation of water bodies, including aquifers, by nonpoint source pollution.

The Watershed Approach

Protecting the state's streams, lakes, bays, and aquifers from the impacts of nonpoint source pollution is a complex process. Texas uses the Watershed Approach to focus efforts on the highest priority water quality issues of both surface water and groundwater. The Watershed Approach is based on the following principles:

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

For groundwater management, the geographic focus is on aquifers rather than watersheds. Wherever interactions between surface water and groundwater are identified, management activities will support the quality of both resources.

The Watershed Approach recognizes that to achieve restoration of impaired water bodies, solutions to water quality issues must be socially equitable, economically viable, and environmentally bearable.

Figure 1.1 **Social, Economic, and Environmental Considerations for Water Quality Restoration**

Watershed Action Planning

A major element in the *Texas Nonpoint Source Management Program* is the inclusion of the Watershed Action Planning (WAP) process and the Nonpoint Source Priority Watersheds Report. The WAP process is an initiative of water quality programs in the state that provides a framework for tracking priority water quality issues from selection through implementation. Partner agencies first review identified water quality issues, which are typically water bodies listed as impaired on the CWA 303(d) list, then determine the best strategy for addressing the issue. Strategies may include further data collection, evaluation of appropriate water quality standards, or development of a watershed-based plan with specific restoration activities. A lead agency is assigned once a strategy is determined and the strategy is evaluated annually to determine progress towards the goal of addressing the water quality issue. Restoration activities identified in watershed-based plans are eligible and prioritized for federal funding for implementation. The WAP process is tracked in one place using an integrated tool that provides for easy access and updating.

Management strategies to address nonpoint source water quality issues are determined through a collaborative approach and documented in the Nonpoint Source Priority Watersheds Report. This comprehensive planning process fosters relationships and facilitates greater coordination and leveraging of resources between state and local water resource agencies.

Funding limitations, new guidelines, increasing populations, and evolving environmental policies create new challenges for the state water quality planning programs. This elevates the importance of incorporating the WAP process in the Nonpoint Source Program to direct funding to watersheds with United States Environmental Protection Agency (EPA) accepted watershed-based plans. The WAP process encourages development of watershed-based plans prior to implementation in order to ensure that nonpoint source funds are spent efficiently and targeted towards well-planned projects.

The WAP process supports the integration of state water quality planning programs by providing a framework and a mechanism for enhanced coordination among state water quality planning programs and stakeholders. The coordination process begins at the local level and allows stakeholders the opportunity to provide a local perspective into water quality management strategies and priorities. Interagency coordination at the state and federal level allows for more effective development of projects, leveraging of resources, and the implementation of water quality management strategies with stakeholder support.

The WAP process integrates information from existing planning tools and from the coordination process to develop and track water quality management strategies. As part of the WAP process, these strategies are documented and periodically updated with the cooperation of the WAP partners. Partners include the TSSWCB, the Clean Rivers Program partners (typically river authorities), and the five TCEQ Water Quality Planning Division program areas—Texas Surface Water Quality Standards Group, Surface Water Quality Monitoring Program, Clean Rivers Program, TMDL Program, and the Nonpoint Source Program. The result of this process is a list of all water quality impairments and special interest water bodies in the state that identifies what will be done to address the impairment or issue, the party responsible for undertaking the action, and a means of tracking progress. The recommended strategies are documented in the WAP Table, which summarizes the water quality management information. The WAP Table is available to the public and located on the TCEQ's website at: http://www.tceq.texas.gov/waterquality/planning/wap/. Data contained in the WAP table, as well as special projects associated with impaired waterbodies, are available through the WAP Public Viewer, an interactive, web-based application. Visit the WAP Public Viewer at https://www80.tceq.texas.gov/WapWeb/public/map.htm. Water quality management strategies identified through the WAP process are implemented on a continuing basis. Since 2012, the WAP process has helped in the prioritization of water bodies for restoration efforts, the collection of water quality data, the adoption of TMDLs, and the completion of watershed protection plans.

Dry Comal Creek *(Source: City of New Braunfels)*

Progress in Improving Water Quality

CHAPTER 2

Section 319(h) of the CWA requires that state nonpoint source annual reports include, "…to the extent that appropriate information is available, reductions in nonpoint source pollutant loading and improvements in water quality… resulting from implementation of the management program."

Section 319(h) of the CWA requires that state nonpoint source annual reports include, "...to the extent that appropriate information is available, reductions in nonpoint source pollutant loading and improvements in water quality... resulting from implementation of the management program."

This specifically applies to the water bodies that have previously been identified as requiring nonpoint source pollution control actions in order to "…attain or maintain applicable water quality standards or the goals and requirements of the Clean Water Act." The three primary ways of measuring improvement in water quality are through:

- measuring actual results from implementing management measures;
- calculating estimated load reductions with the help of models or other calculations; and
- long-term monitoring of the water body.

Other indicators of progress toward water quality improvements include land use modifications or behavioral changes that are associated with reductions in loadings or pollutant concentrations in water bodies. Examples include restored riparian habitat and reduced use of fertilizers and pesticides.

Reductions in Pollutant Loadings

Implementing Best Management Practices at Oil Field Sites on the Colorado River Below E.V. Spence Reservoir

The Railroad Commission of Texas (RRC) identified groundwater affected by historical oil and gas activities at two sites, the Ballinger Seep and Wendkirk Oil Field. Both sites are a probable source of salinity along the Colorado River below the E.V. Spence Reservoir (Segment 1426). Groundwater at these sites contains elevated concentrations of chloride, sulfate, and total dissolved solids. The State-Managed Cleanup Program of the RRC received CWA Section 319(h) funding from the TCEQ to address salinity loading from these two sites. Project activities included assessment and monitoring of the groundwater plumes, aquifer characterization, groundwater modeling, and development and implementation of best management practices (BMPs). The goal of the BMPs was to reduce salinity loading to the river by removing high salinity groundwater from the hydrogeological system.

The BMPs consisted of pumping groundwater from two recovery wells at each site where salinity is the greatest. The recovery wells were installed to penetrate the saturated thickness of the affected aquifers to maximize drawdown and capture of high salinity groundwater. Groundwater was recovered by pneumatic submersible pumps deployed in each recovery well and the contaminated discharge was sent to storage tanks. The groundwater in the tanks was taken to saltwater disposal wells regulated by the RRC. Flow rates and the conductivity of the recovered groundwater are measured and the system is fitted with data loggers and telemetry for remote access monitoring and control. Samples of the groundwater from each recovery well were collected for chloride analysis. The results were used to calculate salinity load reductions for each site. Effectiveness monitoring included gauging water levels in the aquifer to assess the capture zone of each recovery well, and collection of groundwater and surface water samples from select locations along Segment 1426 to evaluate improvements in water quality.

In fiscal year 2017, a total of 18,942 gallons of saline groundwater were recovered from the Ballinger Seep, and a total of 157,349 gallons of saline groundwater were recovered from the Wendkirk Oil Field. Based on the volume removed and the average chloride concentrations detected at each recovery well, the following load reductions were calculated at each site:

Site	Pollutant	Load Reduction
Ballinger Seep	Chloride	1,226 lb[1]
Wendkirk Oil Field	Chloride	24,594 lb

[1] lb – pounds

Implementing the Bastrop Bayou Watershed Protection Plan

In fiscal year 2017, the Houston-Galveston Area Council (H-GAC) used CWA Section 319(h) funds from the TCEQ and the EPA to implement priority management measures identified in the Bastrop Bayou Watershed Protection Plan. In addition to education and outreach, H-GAC focused on decommissioning failing septic systems and installing pet waste stations. A total of seven failing septic systems were decommissioned which resulted in 1,800 gallons of septage removed. Seven pet waste stations were also installed along pedestrian trails. According to literature values referenced in the Bastrop Bayou Watershed Protection Plan the following load reductions were achieved:

Pollutant	Load Reduction
E. coli[1]	4.3×10^{14} cfu/100mL[2]

[1] *E. coli* - Escherichia coli

[2] cfu/100mL – colony forming units per 100 milliliters

Implementing Agricultural Best Management Practices in the Arroyo Colorado Watershed

The Arroyo Colorado River, an ancient distributary channel of the Rio Grande, extends about 90 miles from Mission, Texas to the Laguna Madre in the Lower Rio Grande Valley. The Arroyo Colorado Watershed Protection Plan calls for the voluntary adoption of agricultural BMPs.

In fiscal year 2017, seven certified Water Quality Management Plans (WQMPs) were implemented in the watershed covering 406 acres. Of the 406 acres, 162 acres were cropland and 244 acres were hayland/pastureland. Irrigation water BMPs compose the majority of implementation efforts in the Arroyo Colorado watershed. Irrigation land leveling is a common BMP implemented in the watershed that allows for the equal distribution of water across a field. This practice reduces the amount of irrigated water applied to agricultural lands, therefore, reducing potential runoff. Irrigation pipelines are another common BMP. They improve the previous water conveyance system of open ditches to a more efficient underground pipeline. This practice reduces evaporation rates and the potential for sediment runoff. In fiscal year 2017, a total of 189 acres of irrigation land were leveled and 2,400 feet of irrigation pipeline was installed. These two practices complement each other and have enabled producers to better utilize water resources, while reducing the potential of nonpoint source pollution. According to the Texas Best Management Practices Evaluation Tool, these BMPs achieved the following load reductions:

Pollutant	Load Reduction
Sediment	610 tons
Nitrogen	2,914 lb
Phosphorus	516 lb

Lower Colorado River Authority's Creekside Conservation Program

In fiscal year 2017, the Lower Colorado River Authority (LCRA) continued implementation of the Creekside Conservation Program with CWA Section 319(h) funds from the TSSWCB and the EPA. This program is a partnership between the LCRA, private landowners, the United States Department of Agriculture - Natural Resources Conservation Service (NRCS), and local soil and water conservation districts (SWCDs). The Creekside Conservation Program provides technical and financial assistance to help reduce soil erosion and agricultural nonpoint source pollution on privately owned land. The program is available to landowners in Bastrop, Blanco, Burnet, Colorado, Fayette, Lampasas, Llano, Matagorda, San Saba, Travis, and Wharton counties.

In fiscal year 2017, the Creekside Conservation Program provided financial assistance to 13 producers in the program area. As a result of this effort, 4,527 acres of private land were placed under conservation management plans, consisting of prescribed grazing and upland wildlife habitat management practices. Additional BMPs installed include one pond, three grade stabilization structures, 18 acres of rangeland planting, 24,415 feet of cross fencing, and 439 acres of brush management. According to the Texas Best Management Practices Evaluation Tool, these BMPs achieved the following estimated load reductions:

Pollutant	Load Reduction
Sediment	2,926 tons
Nitrogen	23,687 lb
Phosphorus	3,127 lb

LCRA also focused on education and outreach within the project region by participating in four educational events, a combination of field days, workshops and conferences reaching 305 people. For more information regarding the LCRA Creekside Conservation Program, please visit https://www.lcra.org/community-services/land-conservation.

LCRA Creekside Brush Management *(Source: Marshall Trigg)*

Water Quality Improvements

The TCEQ and the TSSWCB work together to identify water quality improvements where the implementation of nonpoint source BMPs is a contributing factor. Once a strong candidate is identified, a "success story" is written and sent to the EPA for approval. Linking instream nonpoint source pollutant reductions to land management practices is challenging. Changes to the land can occur over varying temporal and spatial scales and contributions to the stream are rainfall driven. As a result, changes in water quality often lag behind the implementation of nonpoint source BMPs, and many years of implementation may be needed before significant improvements in a water body are observed. Despite these challenges, Texas continues to see measurable water quality improvements.

Success Story Highlights

Improving Water Quality in the Lower San Antonio River Through Cooperative Conservation

The Lower San Antonio River was added to the CWA Section 303(d) list of impaired waters in 2000 for not supporting the primary contact recreation use due to high levels of bacteria. In 2006, the TCEQ initiated a TMDL for the water body, which was approved in 2008. Grazing livestock were identified as one of the potential sources of bacteria. As a result, conservation plans were developed and conservation practices were voluntarily implemented by ranchers in the watershed with CWA Section 319(h) grant funding provided by the TSSWCB and the EPA, as well as Environmental Quality Incentives Program (EQIP) funding provided by the NRCS. Through these cooperative conservation efforts, water quality was improved and portions of the Lower San Antonio River (Assessment Units 1901_01 and 1901_05) were removed from the state's list of impaired waters in 2014.

Best Management Practices Implemented

After the TCEQ initiated the TMDL study for the Lower San Antonio River, the local SWCDs and landowners expressed an interest in reducing the bacteria in the river. By partnering with the Karnes County, Wilson County, and Victoria SWCDs, the TSSWCB certified and implemented 25 WQMPs in the watershed. The WQMPs covered a total of 15,961 acres, and included BMPs such as alternative water sources, prescribed grazing, cross-fencing, nutrient management, and grass planting. In addition, the NRCS recognized the need to improve water quality, and dedicated EQIP funding, through the EQIP South Central Texas Resource Concern for Water Quality, to implement conservation practices on 40,291 acres in the watershed.

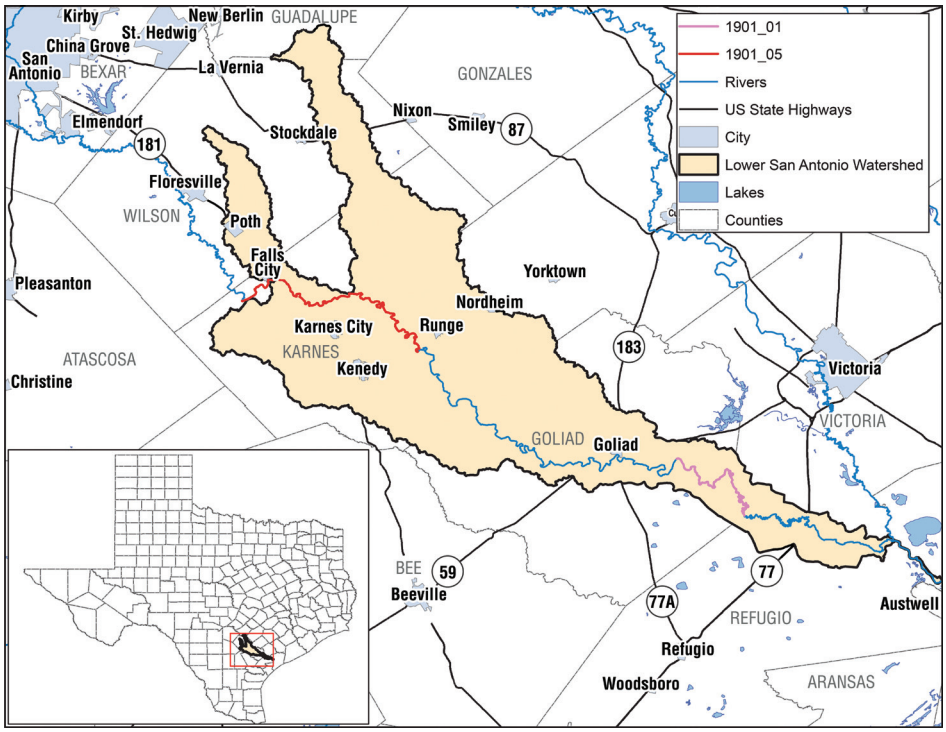
Additionally, the TCEQ partnered with the San Antonio River Authority (SARA) and the City of San Antonio to implement educational activities and BMPs identified in the Upper San Antonio River TMDL Implementation Plan (upstream of Segment 1901) to reduce bacteria loadings.

Water Quality Improvements

Water quality monitoring data show the long-term *E. coli* geometric mean met the state water quality standard for contact recreation, 126 cfu/100mL, in portions of the Lower San Antonio River (109 cfu/100mL for Assessment Unit 1901_01 and 110 cfu/100mL for Assessment Unit 1901_05). These waterbodies currently support all of their designated uses. Water quality monitoring continues in the Lower San Antonio River to track the progress of these efforts in the watershed.

The success of this effort can be attributed to landowners implementing BMPs through WQMPs and conservation plans and an increased awareness of water quality issues through technical assistance. Implementation of BMPs on grazing land continues in the watershed, and an implementation plan for the TMDLs will soon be developed. As a result of these actions, water quality improvement is expected to continue in the Lower San Antonio River.

Figure 2.1 **Map of the Lower San Antonio River Watershed**



Progress Toward Meeting the Goals and Objectives of the Texas Nonpoint Source Management Program

CHAPTER 3

The TCEQ and the TSSWCB have established goals and objectives for guiding and tracking the progress of nonpoint source management in Texas. The goals describe high-level guiding principles for all activities under the *Texas Nonpoint Source Management Program*. The objectives specify the key methods that will be used to accomplish the goals. Although not comprehensive, this chapter reports on a variety of programs and projects that directly support the goals and objectives of the *Texas Nonpoint Source Management Program*.

Clean Water Act Section 319(h) Grant Program

Section 319(h) of the CWA established a grant that is appropriated annually by Congress to the EPA. The EPA allocates these funds to the states to implement activities supporting the congressional goals of the CWA. The TCEQ and the TSSWCB target these grant funds toward nonpoint source activities consistent with the long- and short-term goals defined in the *Texas Nonpoint Source Management Program*.

The grant funds can support a wide variety of activities including implementation of BMPs, technical assistance, financial assistance, education, training, technology transfer, and monitoring to assess the success of specific nonpoint source implementation projects. In fiscal year 2017, Texas received $7,600,000 in CWA Section 319(h) federal grant funds to utilize and award to sub-grantees across the state. In turn, sub-grantees provided $3,040,000 in matching funds to leverage resources used for addressing nonpoint source pollution.

Status of Clean Water Act Section 319(h) Grant-Funded Projects

In fiscal year 2017, the TCEQ had 43 active CWA Section 319(h) grant-funded projects totaling approximately $11.5 million, which addressed a wide range of nonpoint source issues (Figure 3.1). A primary focus of these projects was the development and implementation of watershed protection plans to address urban nonpoint source pollution, targeted outreach and education, Low Impact Development (LID) projects, and TMDL implementation activities.

In fiscal year 2017, the TSSWCB had 32 active CWA Section 319(h) grant-funded projects totaling approximately $8.4 million, which addressed both agricultural and silvicultural nonpoint source pollution (Figure 3.2). Specific projects included developing and implementing watershed protection plans, supporting targeted educational programs, and implementing BMPs to abate nonpoint source pollution from agricultural and silvicultural operations.

Figure 3.1 **TCEQ Fiscal Year 2017 Nonpoint Source Grant Funds by Project Type**

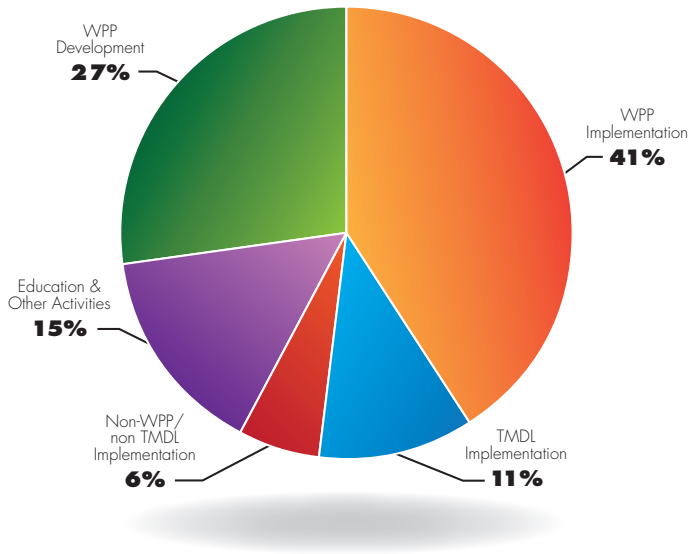
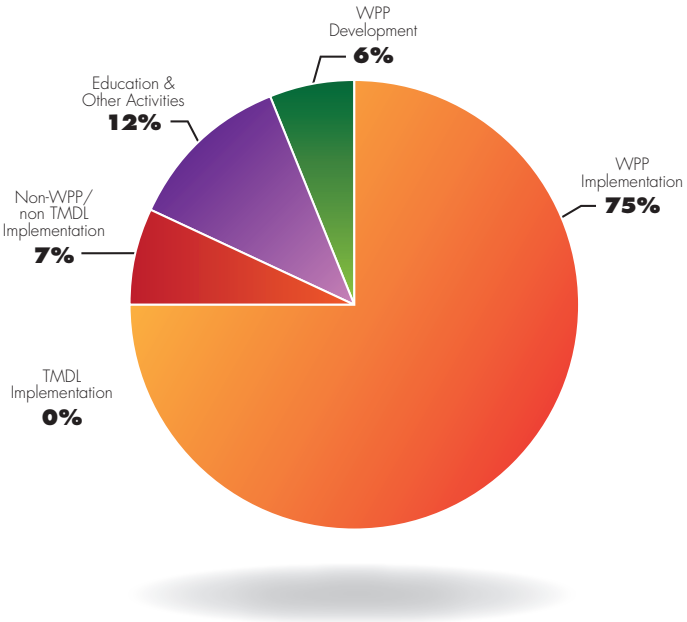


Figure 3.2 **TSSWCB Fiscal Year 2017 Nonpoint Source Grant Funds by Project Type**



Short-Term Goals and Milestones of the Texas Nonpoint Source Management Program

Goal One—Data Collection and Assessment

One of the goals of the *Texas Nonpoint Source Management Program* is to collect and assess water quality data. Data collection requires the coordination of appropriate federal, state, regional, and local entities as well as the private sector and citizen groups. The TCEQ's Surface Water Quality Monitoring Program, operating from the Austin central office and 16 regional offices, conducts both routine ambient monitoring and special studies. In addition, the Clean Rivers Program, which is a collaboration between the TCEQ and 15 regional water agencies, collects surface water quality data throughout the state in response to both state needs and local stakeholder interests. Furthermore, the TCEQ acquires water quality data from other state and federal agencies, river authorities, and municipalities after assuring the quality of the data is comparable to that of data collected by the TCEQ's programs.

Data are assessed by the TCEQ to determine if a water body meets its designated uses or if water quality improvement activities are achieving their intended goals. For impaired waters, water quality data can be used in the development of watershed protection plans and TMDLs. Data are also used to determine potential sources of pollution and the adequacy of regulatory measures, watershed improvements, and restoration plans. The data collection guides the distribution of CWA Section 319(h) grant funds toward water quality assessment activities in high priority watersheds, nonpoint source-impacted watersheds, vulnerable and impacted aquifers, or areas where additional information is needed.

Texas Integrated Report

The Integrated Report describes the status of all surface water bodies in the state evaluated for the given assessment period. The TCEQ uses data collected during the most recent seven to ten year period to assess the quality of surface water bodies in the state. The descriptions of water quality for each assessed water body in the Integrated Report represent a snapshot of conditions during the time period considered in the assessment. Water bodies identified as impaired by nonpoint source pollution are given priority for CWA Section 319(h) grants through the WAP process. The assessment guidance includes methods to determine designated use attainment for water quality standards. These methods are developed by the TCEQ with the advice of a diverse group of stakeholders. The 2014 Integrated Report was approved by the TCEQ in June 2015 and by the EPA in November 2015. The assessment methods for the 2014 Integrated Report are detailed in the *2014 Guidance for Assessing and Reporting Surface Water Quality in Texas* (available online at https://www.tceq.texas.gov/assets/public/waterquality/swqm/assess/14txir/2014_guidance.pdf.

Water Quality Status Categories

The Integrated Report assigns each assessed water body to one of five categories in order to report water quality status

and potential management options to the public, the EPA, state agencies, federal agencies, municipalities, and environmental groups. These categories indicate the status of a water body and describe how the state will approach identified water quality problems. Table 3.1 defines the five categories and shows the number of water bodies assigned to each assessment category in the 2014 Integrated Report.

Table 3.1
Number of Water Bodies Assigned to Each Assessment Category in the 2014 Integrated Report

Category	Definition	Number of Water Bodies
1	Attaining all the water quality standards and no use is threatened.	85
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.	336
3	Insufficient or no data and information to determine if any designated use is attained. Many of these water bodies are intermittent streams and small reservoirs.	127
4	The standard is not supported or is threatened for one or more designated uses but does not require the development of a TMDL.	104
5	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 5 is the *CWA Section 303(d) list*.	401
Total		**1053**

The 303(d) list (Category 5 of the Integrated Report) identifies waters that do not meet Texas surface water quality standards. It is an important management tool produced as part of the Integrated Report and must be approved by the EPA. Water bodies on the 303(d) list are those that require action to restore water quality. An impairment occurs when a water body does not meet a water quality criteria to protect a specific use. The same assessment unit can have multiple impairments. For example, a water body may not meet the criteria for both dissolved oxygen and bacteria; this is considered two impairments. This explains why the total number of impairments in Table 3.2 is greater than the number of water bodies in Category 5 in Table 3.1. 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.

The Integrated Report further divides Category 5 water bodies into subcategories to reflect additional options for addressing impairments:

- Water bodies in Category 5a have a TMDL underway, scheduled, or to be scheduled.
- Water bodies in Category 5b require a review of the water quality standards for the water body to be conducted before a management strategy is selected.
- Water bodies in Category 5c require additional data and information to be collected or evaluated before a management strategy is selected.

Table 3.2 shows the total number of impairments in the 2014 Integrated Report broken down by the category designation. The categories must be applied to each combination of water body and parameter for determining support.

Fulvous Whistling Duck *(Source: Jason Leifester, TCEQ)*

Table 3.2 Number of Impairments in the 2014 Integrated Report

Category	Definition	Water Body Classification		Total Number of Impairments by Category
		Classified[1]	Unclassified	
5	5a—TMDL scheduled or underway	77	55	132
	5b—Water Quality standards review scheduled or under way or undergoing Use Attainability Analysis	55	118	173
	5c—Need additional monitoring	162	127	289
Total Number of Impairments in Category 5		**294**	**300**	**594**

[1]As defined in the Texas Surface Water Quality Standards (Title 30, Chapter 307 of the Texas Administrative Code) classified water bodies are generally large, perennial rivers, lakes, bays and estuaries; unclassified water bodies are smaller in size.

Summary of the 2014 Integrated Report

The 2014 Integrated Report assessed the water quality of 1,409 water bodies. Sufficient data was available to assess uses for 1,053 water bodies which resulted in 589 impairments (Table 3.3). Of the 1,409 water bodies, 401 were classified as Category 5 water bodies (Table 3.1) with a total of 594 impairments (Table 3.2). The number of water bodies classified as Category 5 was a slight decrease from the 2012 CWA Section 303(d) list, which included 410 water bodies, while the total number of impairments increased from 568.

Summary of Impairments on the 2014 Integrated Report

Impairments identified in the 2014 Integrated Report have been grouped by the parameter and the beneficial use of the water body affected (Table 3.3). Elevated levels of bacteria represent the majority of the listed impairments. Many of these bacteria impairments are the result of urban and agricultural nonpoint source pollution. Low dissolved oxygen, impairing many of the same water bodies, is also a leading cause of impairment.

Table 3.3 Summary of Impairments in the 2012 Versus 2014 Integrated Report

Impairment Group	Media	2012 Number of Impairments	2014 Number of Impairments	Use
Bacteria	in water	257	243	recreation
	in water	0	2	general use
	in shellfish	15	8	oyster waters
	beaches	1	2	beach use
Dissolved oxygen	in water	90	96	aquatic life
Toxicity	in ambient water	2	2	aquatic life
	in ambient sediment	6	6	
Organics	in water	0	0	fish consumption, aquatic life
	in fish or shellfish	99	114	
Metals (except mercury)	in water	4	6	fish consumption, oyster waters, aquatic life
	in fish or shellfish	0	0	
Mercury	in water	1	1	fish consumption, oyster waters, aquatic life
	in fish or shellfish	23	24	
Dissolved solids	chloride	11	17	general
	sulfate	9	12	
	total dissolved solids	14	18	
Temperature	in water	0	1	general
pH	in water	17	17	general
Nutrients	nitrogen	0	0	general, public water supply
Biological	habitat, macrobenthic community, or fish community	19	20	aquatic life
Totals		**568**	**589**	

2016 Integrated Report

The Surface Water Quality Monitoring Program continues to work to develop the 2016 Integrated Report. The program is coordinating with the EPA to refine proposed methods and procedures to evaluate nutrients in reservoirs. The TCEQ anticipates releasing the draft 2016 Integrated Report for public comment in fiscal year 2018.

Continuous Water Quality Monitoring

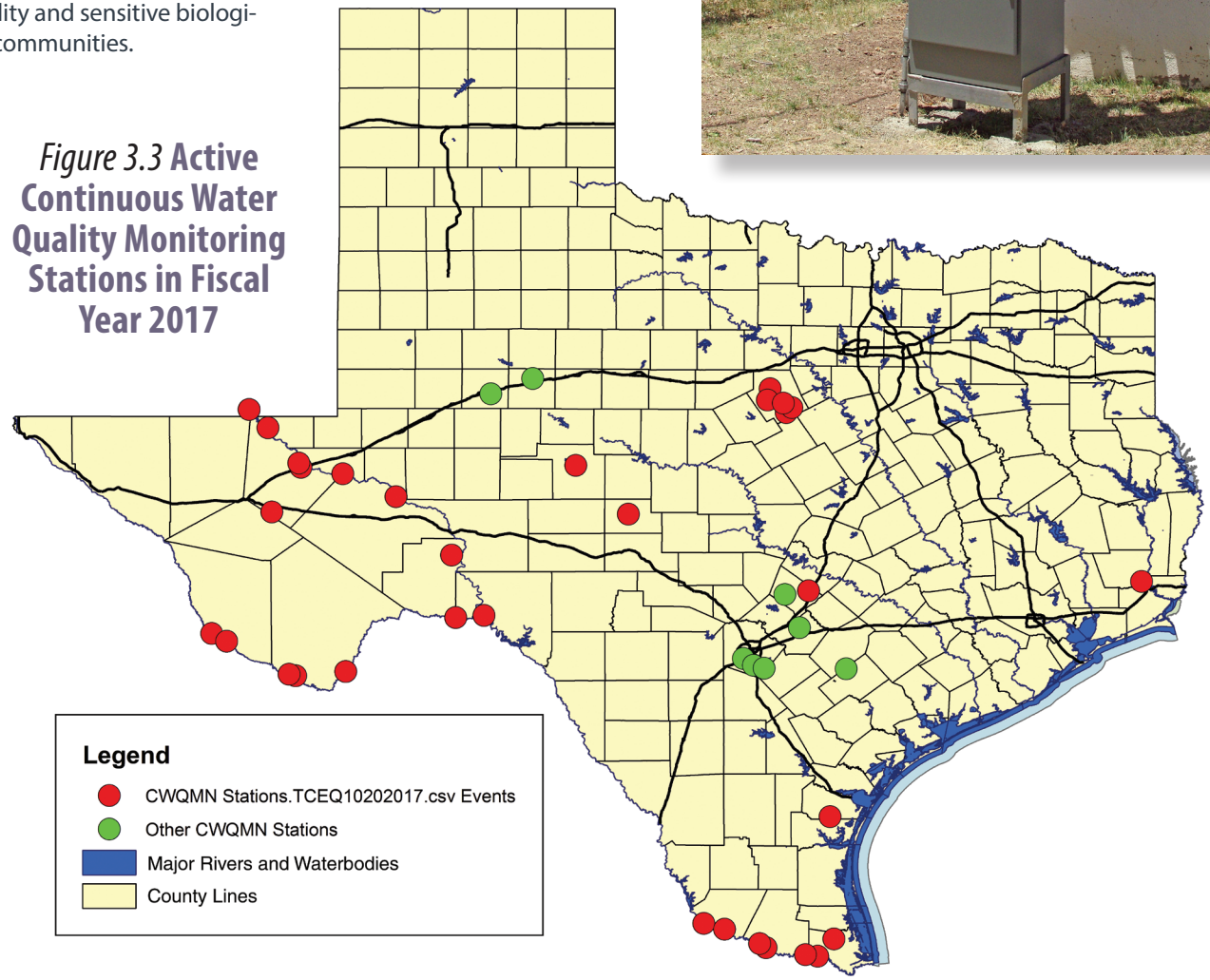
The TCEQ has a network of continuous water quality monitoring sites on priority water bodies. The agency maintains 30-45 sites in its Continuous Water Quality Monitoring Network (CWQMN). The number and locations of sites varies from year to year. In fiscal year 2017, the TCEQ had 40 active sites. At these sites, instruments measure basic water quality conditions every 15 minutes. The CWQMN monitoring data may be used by the TCEQ or other organizations to make water resource management decisions, target field investigations, evaluate the effectiveness of water quality management programs such as TMDL implementation plans and watershed protection plans, characterize existing conditions, and evaluate spatial and temporal trends. Site information and data are available online at https://www.tceq.texas.gov/waterquality/monitoring/swqm_realtime.html.

In fiscal year 2017, CWQMN station C808 was activated at the San Solomon Springs at Balmorhea State Park in west Texas. San Solomon Springs and surrounding springs contributes to the region's water and provide habitat for a number of federally listed endangered species. This area also provides aquatic recreation to approximately 160,000 visitors annually. The biological communities associated with these spring systems have evolved under relatively stable conditions and are sensitive to small changes in water quality. The federally endangered Phantom spring snail (*Pyrgulopsis texana*) and Phantom tryonia (*Tryonia cheatumi*) are sensitive to changes in salinity.

The CWQMN station located at Balmorhea State Park provides an example of how data from the network is used to assess and protect water quality. Station C808 was installed in fiscal year 2017 in conjunction with a United States Geological Survey gaging station to monitor water quantity, temperature, and specific conductivity. The objective of this station is to establish baseline water quality data and to provide continuous water quality information from San Solomon Springs to Texas Parks and Wildlife Department staff. Changes in these parameters could indicate possible pollution. This data would allow the appropriate agencies to take measures to protect water quality and sensitive biological communities.

Station C808 at Balmorhea State Park *(Source: Chuck Dvorsky, TCEQ)*

Figure 3.3 **Active Continuous Water Quality Monitoring Stations in Fiscal Year 2017**



Texas Stream Team Monitoring

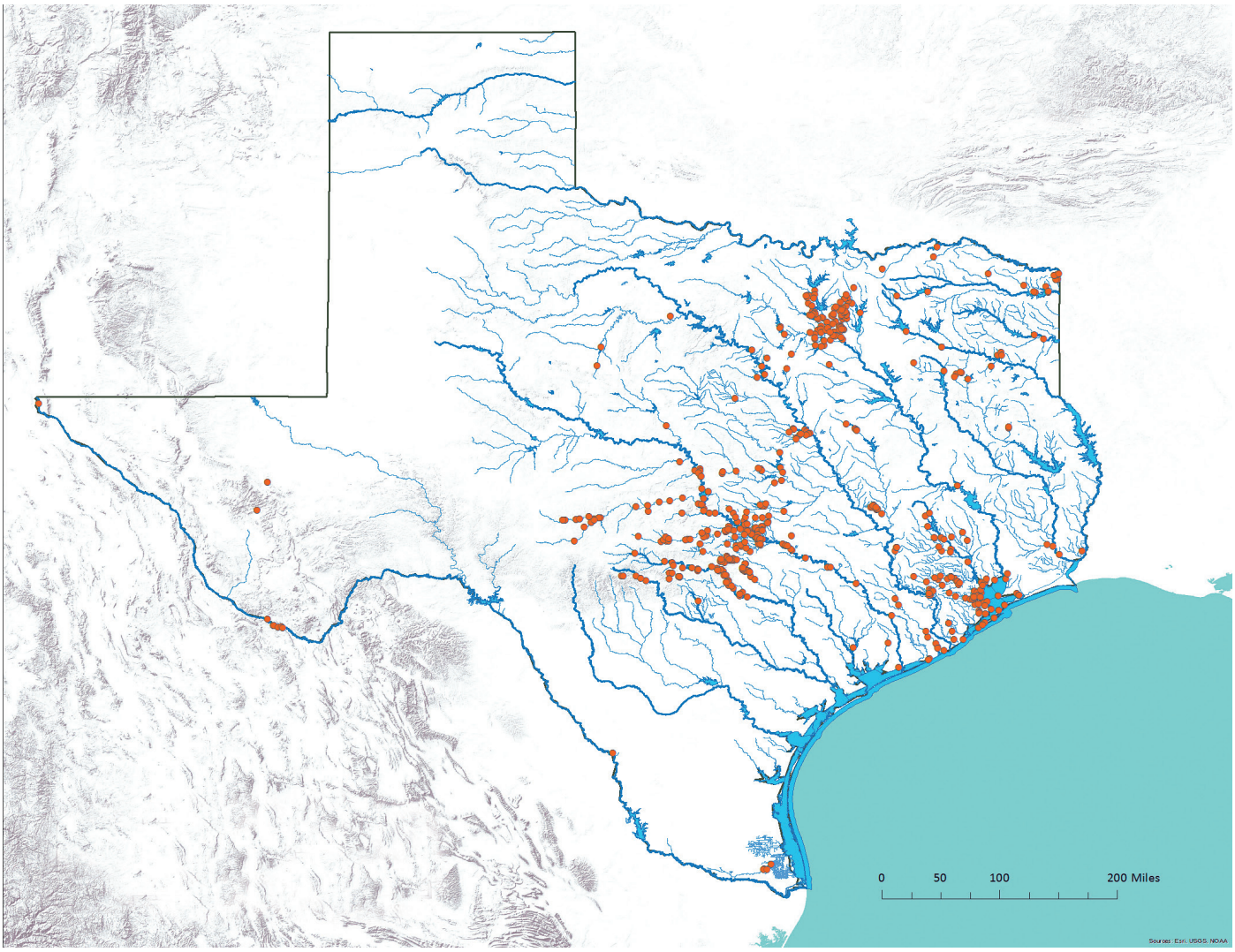
Texas Stream Team is a statewide network of citizen scientists, and partner organizations that is dedicated to monitoring water quality through data collection, stakeholder engagement, and watershed education. The Meadows Center for Water and the Environment at Texas State University receives CWA Section 319(h) funds from the TCEQ and the EPA to administer the program.

Texas Stream Team citizen scientists are certified under a training process to collect water quality parameters from assigned sites along rivers, lakes, and streams. The water quality parameters include temperature, pH, dissolved oxygen, specific conductance, water turbidity, E. coli, nitrate-nitrogen, orthophosphate, and field observations. The data are collected in accordance with an approved Quality Assurance Project Plan. After undergoing a quality assurance check, the data are posted onto Texas Stream Team's Dataviewer, https://aqua.meadowscenter.txstate.edu/, an interactive database/map, where visitors can click on a specific site and download the historical water quality data that have been collected.

Watershed-wide data are also compiled and analyzed in summary reports which are available to partner organizations, local water resource managers, local stakeholders, citizen scientists, and the general public in order to give a more complete picture of the quality of local water bodies. In fiscal year 2017, Texas Stream Team published summary reports of citizen scientists' data in the Middle Guadalupe River and San Gabriel River watersheds.

In fiscal year 2017, Texas Stream Team and its partners trained 511 volunteers in water quality monitoring. Citizen scientists volunteered 4,219 hours of their time and conducted 2,181 monitoring events on rivers, lakes, and streams across Texas. An average of 417 monthly participants drove a total of 42,030 miles throughout the year to collect data on 190 active sites. Many of these monitoring events took

Figure 3.4 **Active Texas Steam Team Monitoring Sites in Fiscal Year 2017**



place on water bodies where there is a watershed protection plan such as Geronimo Creek and Cypress Creek, or where a TMDL is being implemented such as Carters Creek. The data collected by citizen scientists helps watershed coordinators and stakeholders to better understand the environmental conditions of their waters. In addition to water quality monitoring, the Texas Stream Team staff and partners provided watershed education to 1,512 people on nonpoint source pollution and other water quality issues in fiscal year 2017. The Meadows Center for Water and the Environment uses its location at Spring Lake, located at the headwaters of the San Marcos River, to offer watershed education to visitors and educational activities to visiting students from schools across the state. In fiscal year 2017, Texas Stream Team gave eight presentations to 318 students at Spring Lake. In addition, Texas Stream Team staff held 20 education and outreach events around the state and reached an additional 1,637 people.

Goal Two—Implementing Programs to Reduce Nonpoint Source Pollution

The second goal of the *Texas Nonpoint Source Management Program* is to implement activities that prevent and reduce nonpoint source pollution in surface water, groundwater, wetlands, and coastal areas. The objective of this goal is to implement watershed protection plans, TMDL implementation plans, the Texas Groundwater Protection Strategy, TSSWCB-certified WQMPs, as well as implement BMPs on agricultural and silvicultural lands, and other identified priorities.

Implementation Project Highlights

Implementing the Upper San Antonio River Watershed Protection Plan

The Upper San Antonio River Watershed Protection Plan identifies LID demonstrations and pilot studies as management measures to mitigate nonpoint source pollution in the watershed. The term low impact development, or LID, refers to systems and practices that use or mimic natural processes that result in the infiltration, evapotranspiration or use of stormwater in order to protect water quality and associated aquatic habitat. In fiscal year 2017, SARA, with CWA Section 319(h) funding from the TCEQ, implemented these measures by retrofitting two of SARA's urban campuses with LID features.

above: Rainwater Cisterns *(Source: SARA)*

left: Bioretention *(Source: SARA)*

The BMPs were designed to treat an average of 1.8 inches of rainfall using a combination of bioretention, cisterns, and permeable pavement. Nine bioretention features, seven cisterns, and two sections of permeable pavement were installed at the SARA's corporate headquarters and at the Environmental Center to treat over a hundred thousand gallons of runoff. The BMPs were designed to intercept and treat the runoff from each site for bacteria, sediment, nutrients, oils and grease, and heavy metals.

The effectiveness of this project is monitored using automated continuous flow meters at representative sites. By quantifying the amount of runoff that is intercepted and treated by the BMPs, long-term load reductions can be estimated. At the same time, because SARA's corporate headquarters are in a high traffic area, SARA is using the opportunity to educate the public about efforts to protect the San Antonio River from urban runoff. The site is also being used as a demonstration site, with tours conducted during construction and contractor workshops held in the fall and winter of 2017. For more information visit https://www.sara-tx.org/lid-sustainability/guenther-and-euclid-offices-retrofit-project/.

Implementing the Plum Creek Watershed Protection Plan

In 2006, the Plum Creek Watershed Protection Plan was the first plan to be accepted in Texas. In fiscal year 2017, multiple projects were implemented to address bacteria and nutrient concerns in the Plum Creek watershed. The Guadalupe-Blanco River Authority (GBRA) was awarded CWA Section 319(h) funds from the TSSWCB and the EPA and state funds from the TSSWCB to conduct surface water quality monitoring to track improvements in water quality. A partnership between the GBRA, City of Kyle, City of Lockhart, Texas A&M Department of Soil and Crop Sciences, and the TSSWCB provided funds for a year-long bacterial source tracking study of the watershed. Results from the study will be utilized to direct future management efforts in the watershed. In addition, an SWCD technician was hired using CWA Section 319(h) funds from TSSWCB and the EPA to address agricultural nonpoint source pollution. The technician writes and implements WQMPs in the Plum Creek watershed.

The Plum Creek Watershed Protection Plan identifies LID as a management measure to address bacteria and nutrient concerns. In fiscal year 2017, two projects used CWA Section 319(h) funds from the TCEQ and the EPA to install LID features. Caldwell County began construction on LID features at the Caldwell County Justice Center and the City of Kyle prepared plans to install LID features at the City of Kyle's wastewater treatment facility. Both projects include outreach, such as site tours and educational materials, to educate the public on the benefits of LID.

Outreach and education is a critical component of implementation. The ninth Annual Keep Lockhart Beautiful Cleanup and Environmental Fair had 359 volunteers, including more than two dozen youth groups, that removed 2,200 pounds of refuse and recyclable materials from Lockhart parks, Town Branch and Plum Creek. For more information about the Plum Creek Watershed Partnership visit http://plumcreek.tamu.edu/.

Implementing the Leon River Watershed Protection Plan

Segments in the Leon River were placed on the 303(d) list in 1996. By 2008, all but two of the segments in the watershed were impaired for elevated bacteria levels. To address the listing, a TMDL was developed which indicated that a 21% reduction in bacteria levels was needed to restore water quality in the Leon River. As a result of the TMDL, a stakeholder-driven watershed protection plan was developed with CWA Section 319(h) funds from the TSSWCB and the EPA. Both the TMDL and watershed protection plan identified failing septic systems as a contributor of bacteria in the watershed. Stakeholders agreed that additional data was needed to identify the number and location of failing septic systems in the Leon River watershed, as well as provide technical assistance and financial incentives for property owners to address and correct the issue.

The Texas A&M Natural Resources Institute received CWA 319(h) funds from the TCEQ and the EPA to partner with Coryell County to provide technical assistance and financial incentives to qualified property owners for the repair of faulty and failing septic systems located within Coryell County. The goal of this program is to improve water quality in rivers, streams, and tributaries, which can be contaminated by faulty and failing septic systems through soil infiltration, saturation, and surface runoff. A geodatabase was created to track the locations of repaired septic systems relative to the Leon River and its tributaries. The program maximizes water quality improvements by prioritizing septic systems close to water bodies.

In fiscal year 2017, 13 septic systems were replaced through the program, which resulted in 74 lb of nitrogen, 71 lb of phosphorus, and 40.3 X 10^7 cfu/mL of *E.coli* removed from the watershed. An educational workshop to discuss the care and maintenance of septic systems was also held for landowners in the watershed. By evaluating existing septic systems in Coryell County and providing financial incentives to eligible property owners for the repair of faulty or failing septic systems, bacteria levels in local surface water bodies should be reduced to acceptable levels over time.

Total Maximum Daily Loads and Implementation Plans

The TMDL Program develops targets for reducing pollution and helps communities build plans to improve water quality in local waterways. TMDL implementation plans may be developed concurrently with TMDLs to leverage resources and increase the pace at which Texas improves impaired

waterways. In fiscal year 2017, the TMDL Program continued to implement the CWA Section 303(d) Vision. The CWA Section 303(d) Vision enhances overall efficiency of the CWA 303(d) Program and focuses attention on priority waters. The CWA Section 303(d) Vision provides states flexibility in using available tools such as TMDLs, TMDL implementation plans, and watershed protection plans in concert to attain water quality restoration and protection.

Stakeholders provide the local expertise for identifying site-specific problems, targeting areas for attention, and determining what measures will be most effective. Ultimately, it is stakeholders who implement the plans to improve water quality in the rivers, lakes, and bays and achieve long-term success. Several TMDL implementation plans that address nonpoint sources of pollution are supported by CWA Section 319(h) funds (Table 3.4).

Table 3.4 TMDL Watersheds with CWA Section 319(h) Projects

Watershed	Status of Restoration[1]	Links to Project Websites
Lake O' the Pines	Underway	www.tceq.texas.gov/waterquality/tmdl/nav/19-lakepines/19-lakepines.html
Carters Creek	Underway	www.tceq.texas.gov/waterquality/tmdl/85-carterscreek.html
Houston–Galveston Region	Some Improvement	www.tceq.texas.gov/waterquality/tmdl/nav/42-houstonbacteria/42-big-houstonarea
Gilleland Creek	Underway	www.tceq.texas.gov/waterquality/tmdl/nav/69-gillelandcreekbacteria/69-gillelandcreekbacteria.html
Upper San Antonio River	Underway	www.tceq.texas.gov/waterquality/tmdl/34-uppersanantoniobac.html
Arroyo Colorado	Some Improvement	www.tceq.texas.gov/waterquality/tmdl/07-arroyoleg.html
Dickinson Bayou	Underway	www.tceq.texas.gov/waterquality/tmdl/80-dickinsonbayoubacteria.html
Colorado River Below E.V. Spence Reservoir	Restored	www.tceq.texas.gov/waterquality/tmdl/nav/32-colorado/32-colorado.html
North Bosque River	Significant Improvement	www.tceq.texas.gov/waterquality/tmdl/06-bosque.html

[1] Restored only for the parameters addressed in the TMDL implementation plan; the waterway may have other impairments.

Texas Coastal Management Program

The Texas Coastal Management Program (TXCMP) was created to improve coastal management between local, state, and federal entities that manage various aspects of coastal resource use. The TXCMP's mission is to ensure the long-term economic and ecological productivity of the coast. The Texas General Land Office (GLO) administers the TXCMP, and is advised by members of the Coastal Coordination Advisory Committee which includes staff from the TCEQ, TSSWCB, Texas Parks and Wildlife, and the Texas Department of Transportation (TxDOT).

The Coastal Zone Act Reauthorization Amendments (CZARA), Section 6217 of the Federal Coastal Management Act, requires states with approved costal management plans to develop and implement a federally approved program to control nonpoint source pollution in the coastal zone. CZARA requires implementation of 56 management measures across all nonpoint source categories (e.g. urban, forestry, agriculture, hydromodification, construction runoff) to achieve and maintain water quality standards. Management measures are included in the Texas Coastal Nonpoint Source Pollution Control Program. The majority of the management measures have been approved by National Oceanic and Atmospheric Association (NOAA) and EPA; however, several still need to be addressed. These management measures involve septic systems inspections, urban runoff, and non-TxDOT roads, highways, and bridges. The GLO and members of the Coastal Coordination Advisory Committee continue to work with the EPA and NOAA to implement the Texas Coastal Nonpoint Source Pollution Control Program and address these outstanding measures. Final approval of the program is expected by 2019. The outstanding management measures are discussed in more detail in the following sections.

Septic Systems

The Texas Coastal Nonpoint Source Pollution Control Program is implementing several projects to help satisfy CZARA

requirements to inspect septic systems, in the coastal zone. Texas A&M AgriLife Extension, with CWA Section 319(h) funding from the TCEQ and the EPA, implemented a project designed to identify and inspect failing septic systems in the coastal zone. In fiscal year 2017, efforts were concentrated in the Oso Bay watershed near Corpus Christi. Two septic system workshops were delivered, 104 homeowners participated in a door-to-door educational survey, and a total of 22 septic systems were inspected and pumped out.

In fiscal year 2017, a project locating septic systems in the coastal zone was completed. This project used existing "911" emergency response address information, wastewater system service areas, and other information to identify, locate, and characterize septic systems. The inventory estimates there are 63,327 septic systems in the 18 counties of the coastal zone.

above: Septic System Inspection *(Source: Ryan Gerlich, Texas A&M AgriLife Extension)*

Urban Runoff

In fiscal year 2017, Texas continued work on an inventory of urban runoff management practices currently used in the coastal zone to determine areas where Section 6217 management measures are not met. Based upon this information, Texas will design and implement a targeted program to promote and document the use of stormwater management practices outside regulated municipal areas. The program will include education and outreach, and technical and financial assistance. The program will target community officials, land owners, land developers, engineers, financiers, and other local land development professionals and interest groups to emphasize the goal of institutionalizing the use of sustainable stormwater management practices.

Roads, Highways, and Bridges for non-TxDOT Facilities

In fiscal year 2017, Texas continued work on an inventory of roadway management practices currently used in the coastal zone to determine areas where Section 6217 management measures are not met. Based upon this information, Texas will design and implement a targeted assistance program to promote and document the use of sustainable coastal roadway management

right: Survey Training *(Source: Ryan Gerlich, Texas A&M AgriLife Extension)*

practices. TxDOT guidance for roadway planning, design, operation, and maintenance will be promoted for use on non-TxDOT roadways. The program will include education and technical assistance and will target public officials with jurisdictional responsibilities for managing coastal non-TxDOT roadways. The goal of the program is to institutionalize the use of sustainable coastal roadway management practices within each community and jurisdictional area.

Estuary Programs in Texas

Galveston Bay Estuary Program

The Galveston Bay Estuary Program (GBEP) is one of 28 National Estuary Programs in the United States and works with local stakeholders to provide comprehensive ecosystem management through collaborative partnerships to ensure preservation of the bay's multiple uses. Specifically, the GBEP is charged with implementing *The Galveston Bay Plan*—a Comprehensive Conservation Management Plan for Galveston Bay. The GBEP addresses nonpoint source pollution through development and implementation of watershed protection plans, nonpoint source outreach and education, and structural and nonstructural water quality improvement BMPs.

above: The Big Catch *(Source: Texas Creative)*

left: Don't Trash a Good Thing *(Source: Texas Creative)*

below: Our bayous and bay are full of colorful sites, trash shouldn't be one of them *(Source: Texas Creative)*

Back the Bay

Back the Bay is the GBEP's public awareness campaign designed to engage citizens in the Houston-Galveston region to improve water quality, conserve water, and protect fish and wildlife habitat. The campaign was created through a stakeholder-driven process and began with a pilot concept in 2010. By 2013 it was fully implemented in the five-county region surrounding Galveston Bay. In 2017, the campaign's focus was on plastic pollution and aquatic trash. Television and radio public service announcements were produced to demonstrate how the region's bayous and bay are natural wonderlands, full of colorful sights to discover, but trash should not be one of them. The campaign raised awareness in the Houston-metropolitan region with the public service announcement receiving 19 million impressions in the five-county region. The campaign offers a fun and interactive way for residents to learn about the benefits of, and their connection to, the region's natural resource. For more information visit http://www.backthebay.org/.

Coastal Bend Bays and Estuaries Program

The Coastal Bend Bays and Estuaries Program (CBBEP) is another one of the 28 National Estuary Programs that works with local government, stakeholders, conservation groups, industry, and resource managers to improve water quality and restore critical habitats. The CBBEP targets nonpoint source pollution issues by conducting research projects to determine sources of pollution. In addition, the CBBEP participates in the development and implementation of watershed protection plans and TMDL implementation plans. Other CBBEP priority focus areas include land conservation and management, and education through the Delta Discovery program.

A YouTube video named 'All the Cups,' filmed in 2014, prompted the CBBEP to focus efforts on learning more about the sources of marine debris and reducing plastic pollution in Corpus Christi Bay. The video shows a stream of stormwater entering Corpus Christi Bay that was littered with thousands of disposable cups and bottles during a heavy rain event. This video brought awareness to the Coastal Bend community about the large amounts of trash entering the bays during rain events. In fiscal year 2017, the Texas A&M University – Corpus Christi began work with the CBBEP to quantify plastic debris loadings in Corpus Christi and Oso bays during rain events. As a result of a drainage basin study conducted by the City of Corpus Christi, the city installed 28 catch basins in storm drains and will work with CBBEP to install an additional 14 catch basins. This project will decrease the amount of plastic nonpoint source pollution entering Corpus Christi Bay. For more information visit http://www.cbbep.org/.

Texas Groundwater Protection Committee

Groundwater is a major source of water in Texas, providing about half of the 15.2 million acre-feet of water used in the state. Texas' groundwater is used as drinking water for people and livestock, irrigation for crops, and in mining and industrial processes. It also serves as habitat for plants and animals, some of which are endangered species. The Texas Groundwater Protection Committee (TGPC) was established by the Texas Legislature in 1989 as an interagency committee to manage this essential resource. The TGPC consists of nine state entities and an association of groundwater districts. The TGPC strives to improve interagency coordination in the area of groundwater quality protection, and continues developing and updating the comprehensive groundwater protection strategy for the state. The TGPC also identifies areas where new programs could be created, or existing programs could be enhanced, to provide added protection.

Two subcommittees, the Groundwater Issues Subcommittee and the longstanding Public Outreach and Education Subcommittee, execute the majority of the TGPC's responsibilities. Both the Groundwater Issues Subcommittee and the main TGPC have standing agenda items at every meeting for discussion of nonpoint source pollution issues. The Groundwater Issues Subcommittee oversees the cooperative groundwater monitoring program for pesticides in groundwater, which monitors aquifer conditions for select pesticides of interest.

Because contamination of groundwater is easier to prevent than it is to clean up, the TGPC emphasizes groundwater awareness in their outreach and education efforts. Targeting primarily rural Texans, the Public Outreach and Education Subcommittee worked with partner agency Texas A&M AgriLife Extension Service to develop Fact Sheets and Frequently Asked Questions that include nonpoint source pollution information and management practices. Several thousand copies of the Fact Sheets were distributed during visits to the TGPC's traveling display during six Austin area events in fiscal year 2017. The TGPC supported Texas A&M AgriLife Extension Service in conducting several educational events for water well owners and disseminating literature while screening 832 water well samples from 16 counties for basic groundwater quality data. For more information visit the TGPC's website at http://tgpc.state.tx.us/.

Clean Water State Revolving Fund Loans for Nonpoint Source Projects

Another tool available in Texas for addressing nonpoint source pollution is the Clean Water State Revolving Fund (CWSRF), which is administered by the Texas Water Development Board (TWDB). The CWSRF is a financing program authorized under the federal CWA and is partially capitalized by an annual grant from the EPA. This program provides funding assistance in the form of up to 30 year loans at interest rates lower than the market offers, as well as a limited amount of funds which do not have to be repaid. The funds that do not have to be repaid are available to disadvantaged communities as well as for green projects. Although the majority of funds finance publicly owned wastewater treatment and collection systems, the TWDB can also provide CWSRF for nonpoint source pollution abatement and stormwater projects. Funds are available to cities, counties, groundwater conservation districts, SWCDs, and other public agencies, as well as to nonprofit organizations, mainly water supply and/or sewer service corporations.

A water quality-based priority system is used to rank potential applicants and fund projects, including nonpoint source projects. To be eligible, a nonpoint source project must be an identified practice within a WQMP, TMDL implementation plan, or watershed protection plan; a nonpoint source management activity that has been identified in the *Texas Groundwater Protection Strategy*; or a BMP identified in the *Texas Nonpoint Source Management Program* or the National Estuary Program. Loans can be used for planning, designing, acquiring, and constructing wastewater treatment facilities, wastewater recycling and reuse facilities, and collection

systems. Other activities eligible for funding assistance include agricultural, rural, and urban runoff control; estuary improvement; nonpoint source education; and wet weather flow control, including stormwater management activities.

Staff members from the TWDB, the TCEQ, and the TSSWCB meet regularly to coordinate efforts to identify water bodies that are impacted by nonpoint source pollutants and to identify potential applicants for CWSRF assistance. They also identify potential candidates for Green Project Reserve funding, which can provide some loan forgiveness if LID practices are constructed.

Goal Three–Education

The third goal of the *Texas Nonpoint Source Management Program* is to conduct education and technology transfer activities to raise awareness of nonpoint source pollution and activities that contribute to the degradation of water bodies by nonpoint source pollution. Education is a critical aspect of managing nonpoint source pollution. Public outreach and technology transfer are integral components of every watershed protection plan, TMDL, and implementation plan. This section highlights some of the nonpoint source education and public outreach activities conducted in fiscal year 2017.

Texas Well Owner Network

The Texas Well Owner Network (TWON) is an educational training program developed by the Texas A&M AgriLife Extension Service in the Departments of Soil & Crop Sciences and Biological & Agricultural Engineering in partnership with the Texas Water Resources Institute (TWRI). Funded by the TSSWCB with state nonpoint source funds and CWA Section 319(h) funds, TWON educates well owners about water quality BMPs to protect their wells and surface waters from contaminants. TWON works with other project partners to support watershed protection planning and implementation efforts.

There are more than one million private water wells in Texas that provide water to citizens in rural areas and increasingly, to those living on small acreages in the rural-urban interface. Public drinking water supplies are monitored through requirements of the federal Safe Drinking Water Act. However, private well owners are responsible for monitoring the quality of their wells and are therefore at a greater risk for exposure to compromised water quality. Bacteria and nitrates are two of the most common contaminants in private water wells in Texas, as well as frequent causes of surface water quality impairments or concerns.

TWON training is delivered via "Well Educated," a four-six hour course, and "Well Informed," an hour-long presentation. The "Well Educated" training course covers aquifers, household wells, improving and protecting water resources, groundwater resources, septic system maintenance, well maintenance and construction, water quality, and water treatment. The "Well Informed" presentation focuses on wellhead protection and recommendations for remediating well contamination. Through both programs, well owners can bring in water samples to test for fecal coliform bacteria, nitrate-nitrogen, and salinity.

In fiscal year 2017, nine "Well Educated" and 11 "Well Informed" training events were conducted. This resulted in educating more than 600 private water well owners, and the screening of more than 630 water samples. Results from pre-test and post-test evaluations indicate that knowledge was increased for the participants. On average, participants increased their program test scores from 50% pre-program to 80% post-program. Most participants indicated that they were satisfied with the trainings, and more than 96% of participants intend to adopt behavioral changes. Furthermore, results from six-month follow-up evaluations indicated that 90% of well owners needing to remove hazardous material from their well house complied. For participants whose septic tanks needed pumping, 55% had pumped their septic tanks within six months following the program, with an additional 35% planning to pump out their system. Also, 75% of participants said they had shared TWON educational materials with other well owners. To find out when TWON is coming to your watershed visit http://twon.tamu.edu/.

Texas Watershed Stewards

Over the past seven years, Texas A&M AgriLife Extension Service has received state nonpoint source and CWA Section 319(h) grant funds from the TSSWCB and the EPA to sponsor the Texas Watershed Stewards program. Texas Watershed Stewards is a one-day training program designed to increase citizen understanding of watershed processes and foster increased local participation in watershed management and watershed protection planning activities across the state. The program is tailored to, and delivered in, target watersheds with TMDL or watershed protection plan activities.

In fiscal year 2017, ten workshops were conducted in watersheds across the state with a total of 344 attendees. Participants were comprised of landowners, agricultural producers, city personnel and officials, business owners, state and federal environmental agency staff, public schools and universities, environmental and engineering professionals, and other watershed residents. Since the start of the program in 2007, 92 workshops have been conducted with a total of 3,977 attendees.

Pre- and post-test data was collected at each event to determine knowledge gained by workshop attendees with a 34% increase in knowledge reported. Ninety percent of attendees reported the program enabled them to be a better steward of their watershed. Results of six-month follow-up evaluations showed 79% of respondents had participated or planned to participate in at least one community cleanup, 41% participated in local planning or zoning decisions, and 53% indicated they had communicated with their elected

officials regarding water quality issues. Furthermore, 89% of respondents reported they now more closely monitor individual actions that might impact water quality, and 82% have either adopted or maintained management practices that have a positive impact on water quality. To find out when Texas Watershed Stewards is coming to your watershed visit http://tws.tamu.edu/.

Texas Watershed Stewards Training *(Source: Michael Kuitu, Texas A&M AgriLife Extension)*

Lone Star Healthy Streams

The Lone Star Healthy Streams program is a partnership between the Texas A&M AgriLife Extension Service, TSSWCB, and TWRI. The Lone Star Healthy Streams program educates Texas livestock producers and land managers on how to best protect Texas waterways from bacterial contributions associated with the production of livestock as well as feral hogs. Groups of extension specialists, research scientists, resource conservation agencies, agricultural groups, and producers collaborated to compile five Lone Star Healthy Streams manuals, which include BMPs known to reduce *E. coli* contributions to rivers and streams from beef cattle, dairy cattle, horses, poultry and feral hogs. In addition to reducing bacterial contributions, the BMPs listed in the manuals allow livestock and land owners to further protect Texas waterways from sediment, nutrient, and pesticide runoff while also potentially improving the productivity of the property.

The Lone Star Healthy Streams program has been well received by producers and landowners across the state and endorsed by seven livestock groups and three natural resource agencies. In fiscal year 2017, twenty programs were delivered, reaching 1,084 producers throughout Texas and over 50,000 acres. Based on attendee feedback, the Lone Star Healthy Streams programs which were delivered had an anticipated economic impact of over $2,200,000 for attendees that implemented BMPs discussed in the program. In addition to direct delivery of the educational programs, the Lone Star Healthy Streams website averaged over 100 unique visitors per month. Printed copies of the manuals are available for order or can be electronically downloaded on the AgriLife Extension Bookstore. Publication numbers for the manuals are as follows: Beef Cattle (B-6245), Dairy Cattle (B-6253), Horses (B-6254), Poultry (B-6255), and Feral Hogs (B-6256). To facilitate delivery throughout the state, standardized presentations accompanying each manual are given at each program. An online, interactive version of the manuals is being updated for producers and landowners to access at their convenience. For more information visit http://lshs.tamu.edu.

Watershed-Based Feral Hog Management

The Lone Star Healthy Streams Feral Hog program focuses on promoting healthy watersheds through the implementation of watershed-based feral hog educational programming. The program is designed to increase citizen awareness, understanding, and knowledge about feral hogs. Topics covered include the biology of the animals, environmental and economic impacts, methods of removal, and laws and regulations concerning the management of feral hogs in Texas. Additionally, one-on-one technical assistance on feral hog management increases the effectiveness of feral hog population reduction efforts undertaken by the public. These efforts focus on priority watersheds where feral hogs have the potential to contribute to water quality issues. The Lone Star Healthy Streams Feral Hog program is funded by a CWA Section 319(h) grant from the TSSWCB and the EPA. In fiscal year 2017, activities were facilitated by the Texas A&M AgriLife Extension Service's Wildlife and Fisheries Sciences Extension Unit and the Texas A&M Natural Resources Institute. One Extension Associate was employed and centrally housed within priority watersheds.

Working relationships between program staff and watershed coordinators, project managers and other related personnel across the state are maintained through both face-to-face and online collaborations. Additionally, expertise in feral hog related educational programming and field-based technical assistance is provided to county extension agents associated with the Texas A&M AgriLife Extension Service. Collaborations with multiple federal and state agencies and public organizations increase the effectiveness and outreach of this program. For instance, organizations such as the Texas A&M AgriLife Research, Texas A&M Natural Resources Institute,

NRCS, Texas Parks and Wildlife Department, Texas Animal Health Commission, Texas Wildlife Services, Texas Department of Agriculture, Wildlife Management Associations, various private home owners associations and Texas Master Naturalists chapters assisted in programming, resource creation and/or distributing feral hog educational resources.

In fiscal year 2017, four four-hour feral hog management workshops, five two and half-hour programs, one two-hour program, 28 one-hour programs, and one educational booth were conducted. These programs had a total of 2,367 attendees with a total of 3,318 direct contact hours. In addition, nine direct technical assistance site visits were conducted within priority watersheds. Post program evaluations showed that 98% of surveyed participants reported knowledge gained concerning feral hog biology, legal control options, efficient trap/bait techniques and types/extent of feral hog damage. The statewide online feral hog reporting tool documented a total of 252 hogs sighted or removed based on 34 total reports. Educational resources created in fiscal year 2017 included four "Wild Pig Newsletters" with 343 subscribers and an online reach of 6,514 readers via Facebook, two blog articles with 1,728 reads, two web videos with 558 views, one extension publication and one distance-based learning module. In fiscal year 2017, the feral hogs Facebook page received 487 "Likes" with a total reach of 58,310 users and the feral hogs Twitter page had a total of 680 followers from 481 tweets. A total of four AgriLife Communications news releases and four news media interviews further promoted educational programs and feral hog abatement within priority watersheds. For more information visit http://lshs.tamu.edu/.

Texas A&M Forest Service

The Texas Silvicultural Best Management Practice Education and Implementation Project, administered by Texas A&M Forest Service through a CWA Section 319(h) grant from the TSSWCB and the EPA, mitigates silvicultural nonpoint source pollution and promotes the role of forests in watershed protection. The sustained success this program has achieved is directly related to the extensive education, outreach, and technical assistance provided by the staff implementing the project. In fiscal year 2017, Texas A&M Forest Service personnel coordinated landowner workshops, contractor training sessions, professional seminars, public outreach and other educational events, reaching over 5,000 people with the message of sustainable forestry, BMPs, and water quality protection.

In fiscal year 2017, a smartphone application of the *Texas Forestry Best Management Practices Handbook* (May 2014) was downloaded over 500 times. Users have quick, easy, and searchable access to the Texas forestry BMP guidelines, along with new digital tools, such as a clinometer to measure slope and a location tool to identify the soil series and properties at a specific location. In fiscal year 2017, the online forest operation planning tool named "Plan My Land Operation" had almost 3,000 sessions and a new forestry BMP pocket guide was developed to help landowners understand forestry management practices.

This program directs attention to water resource protection efforts throughout the state. Land stewardship is critical to water resource protection, especially following significant wildfires. The Texas A&M Forest Service is working closely with landowners to restore windbreaks and riparian

Technical assistance to landowners *(Source: Texas A&M Agrilife Extension)*

buffers in the Panhandle after the wildfires in spring 2017. In addition, urban forests play an important role in green infrastructure, contributing to stormwater reduction, water quality improvement, and increased effectiveness of existing stormwater BMPs. The value of these BMPs are demonstrated in a new, portable watershed exhibit that models stormwater runoff and infiltration of various landscapes.

Coordinating project efforts is critical to building cooperation, enhancing outcomes, and achieving results. Project personnel routinely meet with stakeholder groups to share information and identify opportunities for collaboration. The BMP/Wetland Coordinating Committee, chaired by the Texas A&M Forest Service, provides a venue for state and federal agencies, academia, industry, and landowners to meet annually. As a result of these relationships, the Texas Forests and Drinking Water Partnership was formed with Texas A&M Forest Service as the lead agency. This initiative seeks to increase awareness of and communication between the forest and water sectors because these natural resources are interdependent. The partnership has established work groups, identified priority watersheds, directed conservation funding, and generated momentum for practicing sustainable forestry, implementing BMPs, mitigating nonpoint source pollution, and protecting drinking water sources.

Student Conservation Association

The Student Conversation Association (SCA) with CWA Section 319(h) funds from the TCEQ and the EPA, held community service events to improve water quality in Milby Park located in the Sims Bayou Tidal watershed in Houston. Water quality issues in the water body include dioxin and polychlorinated biphenyls in edible tissue and depressed dissolved oxygen. Milby Park is a 67-acre public park with a 2,000-linear foot boundary along Sims Bayou Tidal surrounded by an industrialized area. This park was identified for the development of a riparian zone because it provides opportunities to implement habitat restoration measures and watershed stewardship activities.

In fiscal year 2017, two events engaged 100 local residents in habitat restoration and watershed stewardship activities. Community volunteers were recruited using social media, flyers, and SCA's network of local partner organizations. Community volunteers, in collaboration with project partners, participated in native planting and debris removal. The combined efforts of SCA interns, crews, and community volunteers resulted in 2,000 trees planted in the six-acre riparian area and reseeding the area with a native riparian seed mix. Additionally, a portion of the project area was divided into twelve, half-acre sections that have undergone six different herbaceous management methods. The mow, mat, mulch, till, herbicide, and no treatment sections are monitored monthly through vegetation plots to determine which BMPs are effective for controlling invasive herbaceous vegetation. More community planting events are scheduled for fiscal year 2018. For more information visit https://www.thesca.org/serve/program/houston-tx.

Tree Planting at Milby Park *(Source SCA)*

Developing and Implementing Watershed Protection Plans

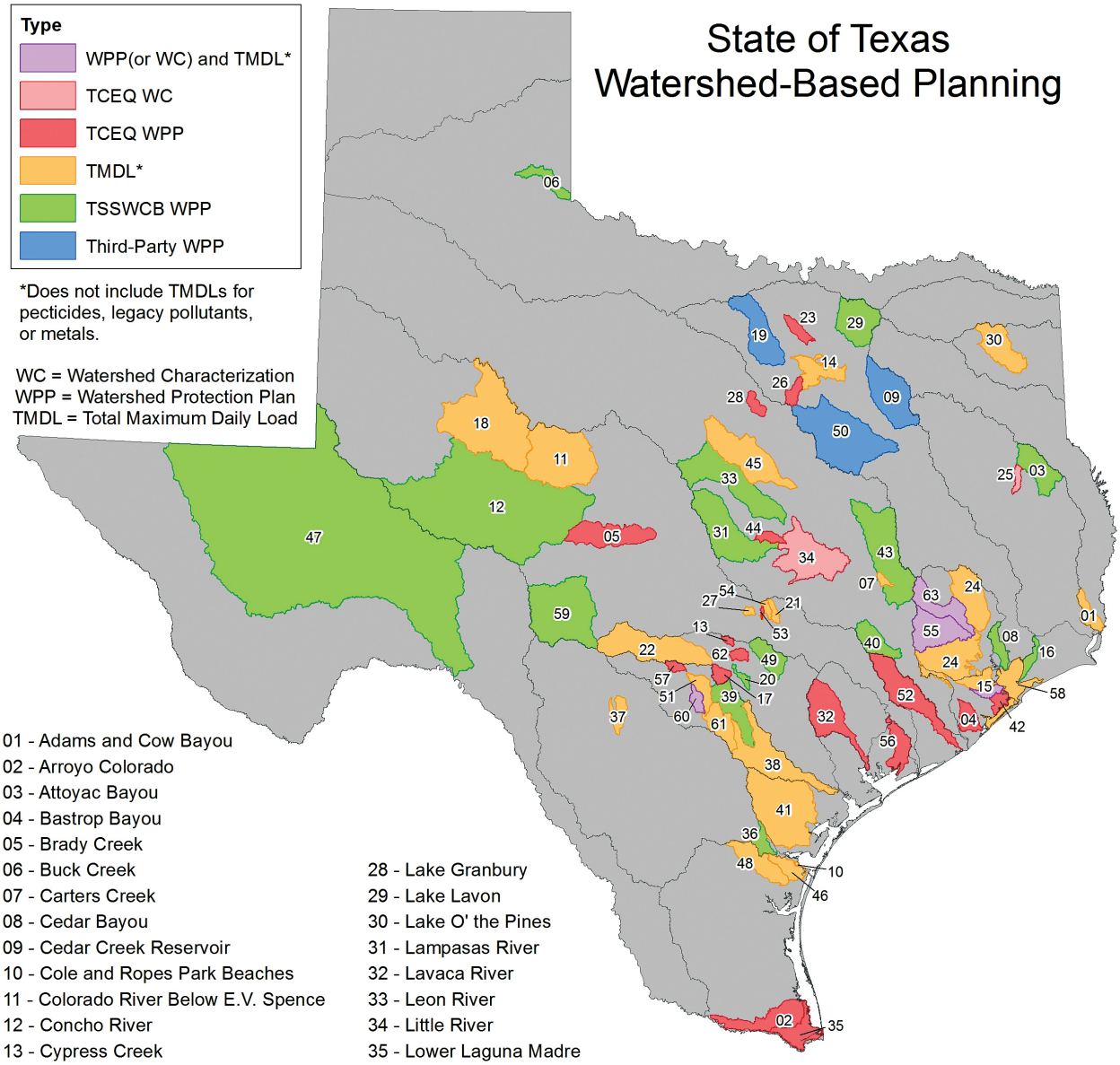
CHAPTER 4

The TCEQ and the TSSWCB apply the Watershed Approach to managing nonpoint source pollution by supporting the development and implementation of watershed protection plans. These plans are developed through local stakeholder groups who coordinate activities and resources to manage water quality. In Texas, watershed protection plans facilitate the restoration of impaired water bodies and the protection of threatened waters before they become impaired. These stakeholder-driven plans give the decision-making power to the local groups most vested in the goals specified in the plans. Bringing groups of people together through watershed planning efforts combines scientific and regulatory water quality factors with social and economic considerations. While watershed protection plans can take many forms, the development of plans funded by CWA Section 319(h) grants must follow guidelines issued by the EPA. These guidelines can be found in the *Nonpoint Source Program and Grants Guidelines for States and Territories*, https://www.epa.gov/nps/319-grant-program-states-and-territories.

In fiscal year 2017, the TCEQ and the TSSWCB facilitated the development and implementation of 38 watershed protection plans throughout Texas by providing technical assistance and/or funding through grants to regional and local planning agencies and, thereby, to local stakeholder groups. A significant portion of the funding to address nonpoint source pollution under the federal CWA is dedicated to the development and implementation of watershed protection plans in areas where nonpoint source pollution has contributed to the impairment of water quality. In Texas, watershed protection plans are also developed by third parties independent from the TCEQ and the TSSWCB. Table 4.1 is a list of watershed protection plans which are under development or being implemented. Figure 4.1 is a more extensive list and map of watershed protection plans and TMDL implementation plans being developed or implemented in Texas at the end of fiscal year 2017. Neither the map nor table is intended to be a comprehensive list of all the watershed planning efforts currently underway in Texas because there may be other local planning efforts not funded by CWA Section 319(h) funds.

La Nana Creek *(Source: Angelina Neches River Authority)*

Figure 4.1 Map of Watersheds with Watershed Protection Plans, Watershed Characterization, or TMDL Implementation Plans Being Developed or Implemented



01 - Adams and Cow Bayou
02 - Arroyo Colorado
03 - Attoyac Bayou
04 - Bastrop Bayou
05 - Brady Creek
06 - Buck Creek
07 - Carters Creek
08 - Cedar Bayou
09 - Cedar Creek Reservoir
10 - Cole and Ropes Park Beaches
11 - Colorado River Below E.V. Spence
12 - Concho River
13 - Cypress Creek
14 - Dallas - Fort Worth Area TMDLs
15 - Dickinson Bayou
16 - Double Bayou
17 - Dry Comal/Comal
18 - E.V. Spence Reservoir
19 - Eagle Mountain Reservoir
20 - Geronimo Creek
21 - Gilleland Creek
22 - Guadalupe River Above Canyon Lake
23 - Hickory Creek
24 - Houston Area TMDLs
25 - La Nana Bayou
26 - Lake Arlington and Village Creek
27 - Lake Austin
28 - Lake Granbury
29 - Lake Lavon
30 - Lake O' the Pines
31 - Lampasas River
32 - Lavaca River
33 - Leon River
34 - Little River
35 - Lower Laguna Madre
36 - Lower Nueces River
37 - Lower Sabinal River
38 - Lower San Antonio River
39 - Mid and Lower Cibolo
40 - Mill Creek
41 - Mission and Aransas
42 - Moses-Karankawa Bayous
43 - Navasota Below Lake Limestone
44 - Nolan Creek
45 - North Bosque River
46 - Oso Bay and Oso Creek
47 - Pecos River
48 - Petronila Creek
49 - Plum Creek
50 - Richland-Chambers
51 - Salado Creek
52 - San Bernard
53 - Shoal Creek
54 - Spicewood Springs and Walnut Creek
55 - Spring and Cypress Creek
56 - Tres Palacios
57 - Upper Cibolo Creek
58 - Upper Coast Oyster Waters
59 - Upper Llano River
60 - Upper San Antonio River
61 - Upper San Antonio River
62 - Upper San Marcos
63 - West Fork San Jacinto and Lake Creek

Table 4.1 Watershed Protection Plans Being Implemented or Under Development in Texas

TSSWCB WPPs	Links
Attoyac Bayou	http://attoyac.tamu.edu/
Buck Creek	http://buckcreek.tamu.edu/
Cedar Bayou	http://www.cedarbayouwatershed.com/
Concho River	http://www.tsswcb.texas.gov/managementprogram/conchowpp
Double Bayou	http://www.doublebayou.org/
Geronimo Creek	http://www.geronimocreek.org/
Lake Lavon	https://www.ntmwd.com/watershed-planning/
Lampasas River	http://www.lampasasriver.org/
Leon River	http://leonriver.tamu.edu/our-watershed/
Lower Nueces River	http://www.nuecesriverpartnership.org/
Mid and Lower Cibolo Creek	http://cibolo.tamu.edu/
Mill Creek	http://millcreek.tamu.edu/
Navasota River	http://navasota.tamu.edu/
Pecos River	http://pecosbasin.tamu.edu/
Plum Creek	http://plumcreek.tamu.edu/
Upper Llano River	http://www.llanoriver.org/
TCEQ WPPs	**Links**
Arroyo Colorado	http://arroyocolorado.org/watershed-protection-plan/
Bastrop Bayou	http://www.bastropbayou.org/
Brady Creek	http://www.ucratx.org/brady.html
Cypress Creek	http://www.cypresscreekproject.net/
Dry Comal/Comal River	http://www.nbtexas.org/1914/Watershed-Protection-Planning
Hickory Creek	http://www.hickorycreekwatershed.org/
Highland Bayou & Moses-Karankawa Bayous	http://www.agrilife.org/highlandbayou/
Lake Arlington/Village Creek	http://www.trinityra.org/lakearlingtonvillagecreek
Lake Granbury	https://www.brazos.org/About-Us/Water-Quality/Watershed-Protection-Plans/Lake-Granbury-WPP
Lavaca River	http://matagordabasin.tamu.edu/lavaca/
Lower Laguna Madre/ Brownsville Ship Channel	http://www.arroyocolorado.org/lower-laguna-madrebrownsville-ship-channel-watershed/
Nolan Creek	http://www.nolancreekwpp.com
San Bernard River	http://www.h-gac.com/community/water/watershed_protection/san-bernard-river.aspx
Tres Palacios Creek	http://matagordabasin.tamu.edu/
Upper Cibolo Creek	http://www.ci.boerne.tx.us/147/Upper-Cibolo-Creek-Watershed
Upper San Antonio River	http://www.bexarfloodfacts.org/watershed_protection_plan/
Upper San Marcos River	http://smwatershedinitiative.wp.txstate.edu/
West Fork of San Jacinto	http://www.westfork.weebly.com/

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Table 4.1 Watershed Protection Plans Being Implemented or Under Development in Texas *(continued)*

TCEQ Watershed Characterizations	Links
Cypress Creek (San Jacinto River Basin)	http://www.westfork.weebly.com//
La Nana Bayou	Under Development
Little River	http://littleriver.tamu.edu/
Spring Creek	http://westfork.weebly.com/
Bridge Documents (Accepted by EPA as WPPs)	**Links**
Colorado River Below EV Spence Reservoir	www.tceq.texas.gov/waterquality/nonpoint-source/mgmt-plan/watershed-pp.html
Dickinson Bayou	Under Development
Mission and Aransas	Under Development
Third-Party WPPs	**Links**
Cedar Creek Reservoir	http://nctx-water.tamu.edu/media/1475/ccwpp.pdf
Eagle Mountain Reservoir	http://www.trwd.com/water-supply/environmental/environmental-stewardship/watershed-protection/
Richland Chambers	http://www.trwd.com/water-supply/environmental/environmental-stewardship/watershed-protection/

Watershed Protection Plan Highlights

Dry Comal Creek and Comal River

The Dry Comal Creek and Comal River watershed span from southeast of Canyon Lake near Highway 46, toward the City of Garden Ridge and to the City of New Braunfels. The watershed is located within the Guadalupe River Basin and is situated primarily in Comal County. The Dry Comal Creek was placed on the 2010 303(d) list for exceeding bacteria limits for primary contact recreation. While not listed as impaired, routine monitoring of the Comal River indicated that concentrations of bacteria in this segment were increasing over time. In 2014, the City of New Braunfels partnered with the GBRA and Edwards Aquifer Authority and received CWA Section 319(h) funds from the TCEQ and the EPA to characterize the sources of bacteria in the watershed and develop a watershed protection plan.

Development of the Watershed Protection Plan

The City of New Braunfels, GBRA, Edwards Aquifer Authority, local stakeholders, and a technical advisory group formed a watershed partnership to develop the watershed protection plan. The partnership has regular meetings, including six meetings in fiscal year 2017. In the fall of 2013 and 2016, the City used funding from the partnership to collect samples from the Dry Comal Creek and the Comal River, and analyzed the samples using bacteria source tracking to identify potential sources of bacteria found in the waterbodies. The bacterial source tracking results indicated approximately 60-70% of the bacteria were from wildlife, particularly deer and non-native avian wildlife. Approximately 20% of the bacteria were from livestock and domestic animals.

Stakeholders selected BMPs for each bacteria source, based upon characterization of the watershed, bacterial source tracking results, stakeholder knowledge, and recommendations from the technical advisory group. In reference to identified implementation goals, the partnership developed a detailed schedule, cost estimate, and estimated potential bacteria load reduction for each BMP.

Education and Outreach Activities

The partnership developed a proactive and detailed outreach and education plan to inform citizens of the negative impacts of feeding wildlife. Involvement and long-term commitment by the community and stakeholders is critical in the watershed because the population of the largest bacteria sources, deer and non-native avian wildlife, has increased due to feeding. Education efforts include social media and news campaigns, youth activities, local community activities, workshops and a public outreach campaign to inform and educate residents, businesses, and visitors about the negative impacts that feeding wildlife has both to the wildlife and to water quality.

In fiscal year 2017, the watershed partnership initiated outreach and education activities while the watershed protection plan was under development. In addition to regular stakeholder meetings, the partnership maintained a website and developed a two-page infographic and core message to facilitate effective communication with the community and visitors. In fiscal year 2017, the partnership had three news

releases, led four watershed tours, hosted a Texas Watershed Stewards workshop, conducted ten youth activities or presentations, and provided education at four local community events, all related to improving water quality in the watershed.

Watershed Implementation Activities

The management measures in the watershed protection plan focus initial efforts on the development of a Do-Not-Feed Wildlife Ordinance and Campaign, which will be supplemented with active management strategies to address overabundant urban and non-native wildlife. The partnership will also work with landowners and local SWCDs to develop WQMPs to address pollutants from livestock. Additional activities include structural and non-structural stormwater BMPs, septic system inspections and repairs, and improved pet waste management. The education and outreach plan will continue to be implemented throughout the watershed. For more information on the Dry Comal Creek and Comal River watershed protection plan visit http://www.nbtexas.org/1914/Watershed-Protection-Planning,

Comal River at Landa Park *(Source: City of New Braunfels)*

Geronimo and Alligator Creeks

In 2008, the GBRA and Texas A&M AgriLife Extension Service received CWA Section 319(h) funds from the TSSWCB and the EPA to address the elevated levels of bacteria and nitrate-nitrogen in Geronimo and Alligator Creeks. The Geronimo and Alligator Creeks watershed partnership was formed in 2010 to develop a watershed protection plan. The plan was accepted by EPA in 2012 and implementation efforts have been ongoing throughout the watershed.

Education and Outreach Activities

In fiscal year 2017, several workshops were hosted in the Geronimo and Alligator Creeks watershed. Workshops included a Lone Star Healthy Streams Beef Cattle and Dairy Workshop with 49 attendees, a Smart Growth Workshop with 31 attendees, a rainwater harvesting workshop with 36 attendees, and a homeowner septic system maintenance workshop that certified 55 homeowners to maintain their aerobic septic systems. The Geronimo and Alligator Creeks partnership has an active website to connect with and inform local stakeholders. Since its creation in 2009, the Geronimo and Alligator Creeks website has over 100,000 visits with an average of over 1,700 visits per month. The mobile-friendly website houses the watershed newsletter "The Geronimo Flow", along with other important watershed information such as upcoming workshops. The newsletter reaches 530 stakeholders with each issue.

Watershed Implementation Activities

In fiscal year 2017, the partnership sponsored a soil testing campaign to educate residents on the importance of proper soil nutrient management. The campaign was advertised through partnership e-mails and press releases. Samples were collected by the local Comal and Guadalupe counties Extension offices with a total of 76 soil samples submitted and analyzed by the Texas A&M Soil, Water, and Forage Testing Laboratory. The results were distributed to the landowners at an event in Seguin, where the Texas A&M Assistant Professor of Soil Nutrient and Water Resource Management, provided interpretations of the laboratory results and explanations of how these results could improve nutrient enrichment practices. Attendees were taught about proper fertilizer applications in order to save money, time, and increase watershed health during common crop, lawn, and pasture maintenance. There were also efforts to address agricultural nonpoint source pollution in the watershed. The Comal-Guadalupe SWCD technician provided agricultural producers technical and financial assistance for the development and implementation of four WQMPs.

The fifth annual Geronimo and Alligator Creeks clean up event was held in April 2017. The event was coordinated by the Geronimo and Alligator Creeks partnership, Texas A&M AgriLife Extension and the GBRA as part of implementation efforts for the watershed protection plan. A total of 181 volunteers worked to remove 1,900 pounds of trash and debris from 27 locations along 17 miles of creek banks and road crossings. For more information on implementation activities visit http://www.geronimocreek.org/.

Creek Cleanup at Geronimo Creek *(Source: Texas A&M AgriLife Extension)*

Abbreviations

BMP	Best Management Practice
CBBEP	Coastal Bend and Bays Estuary Program
cfu/100mL	colony forming units per 100 milliliters
CWA	Clean Water Act
CWQMN	TCEQ Continuous Water Quality Monitoring Network
CWSRF	Clean Water State Revolving Fund
CZARA	Coastal Zone Act Reauthorization Amendment
E. coli	*Escherichia coli*
EPA	U.S. Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
GBEP	TCEQ Galveston Bay Estuary Program
GBRA	Guadalupe-Blanco River Authority
GLO	Texas General Land Office
GRTS	Grants Reporting and Tracking System
H-GAC	Houston-Galveston Area Council
Integrated Report	Texas Integrated Report of Surface Water Quality for Clean Water Act Sections 305(b) and 303(d)
lb	Pounds
LCRA	Lower Colorado River Authority
LID	Low Impact Development
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
RRC	Railroad Commission of Texas
SARA	San Antonio River Authority
SCA	Student Conservation Association
SWCD	Soil and Water Conservation District
TCEQ	Texas Commission on Environmental Quality
TGPC	Texas Groundwater Protection Committee
TMDL	Total Maximum Daily Load
TSSWCB	Texas State Soil and Water Conservation Board
TWDB	Texas Water Development Board
TWON	Texas Well Owner Network
TWRI	Texas Water Resources Institute
TXCMP	Texas Coastal Management Program
TxDOT	Texas Department of Transportation
WAP	Watershed Action Planning
WC	Watershed Characterization
WPP	Watershed Protection Plan
WQMP	Water Quality Management Plan

Appendix

ABBREVIATIONS & APPENDIX

Texas Nonpoint Source Management Program Milestones

Goals / Objectives	Milestone	Milestone Description	Milestone Measurement	2017[1] Estimate	2017 Actual	Comments
ST1/A	Nonpoint Source Assessment Report	The state will produce the Integrated Report in accordance with applicable EPA guidance	Integrated Report	0	0	
LT/2	Nonpoint Source Management Program Updates	The state will update the Management Program in accordance with applicable EPA guidance	Management Program updates	1	0	Update will be finalized in fiscal year 2018.
LT/7	Nonpoint Source Annual Report	The state will produce the Nonpoint Source Annual Report in accordance with applicable EPA guidance	Nonpoint Source Annual Report	1	1	Will be printed in January 2018
LT/2-5	Section 319(h) Grant Program Solicitation	The state will conduct individual TCEQ and TSSWCB solicitations for Section 319(h) grant funding	Grant Solicitation documentation	2	2	One from each agency
LT/2-5	Section 319(h) Grant Program Application	The state will prepare individual TCEQ and TSSWCB grant program applications and submit them to EPA for Section 319(h) grant funding	Grant Application documentation	2	2	One from each agency
LT/2	Section 319(h) Grant Program Reporting	The state will report grant funded activities to the Grants Reporting and Tracking System (GRTS) in accordance with EPA guidance	GRTS updates	4	4	Two semi-annual updates from each agency

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Texas Nonpoint Source Management Program Milestones *(continued)*

Goals / Objectives	Milestone	Milestone Description	Milestone Measurement	2017[1] Estimate	2017 Actual	Comments
ST2/A	Priority Watersheds Report Updates	The state will update the Priority Watersheds Report based upon information and recommendations derived through the Watershed Action Planning process as described in the Management Program	Priority Watersheds Report Updates	0	0	Update will be finalized in fiscal year 2018.
ST3/C,D	Watershed Training	The state will provide training to watershed professionals to ensure quality and consistency in the development and implementation of watershed protection efforts	Texas Watershed Planning Short Course	1	1	
ST3/A,B,F,G	Watershed Education	The state will provide watershed education to help citizens participate in programs designed to address water quality issues	Texas Watershed Steward Program (number of workshops)	10	10	
ST3/C,D	Watershed Training	The state will provide a forum to facilitate the transfer of information between watershed professionals in the state	Texas Watershed Coordinator Roundtable	2	2	
ST3/B,F,G	Volunteer Monitoring	The state will provide support for local volunteer monitoring groups. These groups provide water quality data to the state water quality planning program and gain insight into resolving water quality issues	Texas Stream Team Participation (numbers of stations/sites monitored)	250	511	From Texas Stream Team annual report
ST3/C,F,G	Urban best management practices	The state will provide technical and financial assistance to local communities to support the implementation of urban best management practices	Coastal Urban BMP Guidance Manual	0	0	
ST1/B	Quality Assurance	The state will ensure that monitoring procedures are in compliance with EPA-approved TCEQ and TSSWCB Quality Management Plans	Annual Quality Management Plan updates	2	2	One from each agency
ST1/C	Watershed Characterization	The state will support the implementation of projects designed to evaluate watershed characteristics and produce the information needed for watershed and water quality models	Watershed characterization projects	0	4	

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Texas Nonpoint Source Management Program Milestones *(continued)*

Goals / Objectives	Milestone	Milestone Description	Milestone Measurement	2017[1] Estimate	2017 Actual	Comments
ST2/A,C	Watershed Coordination	The state will support watershed coordination projects which facilitate the implementation of WPPs	Watershed coordination projects	0	15	
ST1/D	Develop WPPs	The state will support projects which provide for the development of WPPs which satisfy applicable EPA guidance	WPP development projects	0	7	
ST2/D	Implement WPPs	The state will support projects which provide for the implementation of management measures specified in WPPs which satisfy applicable EPA guidance	WPP implementation projects	0	38	
ST1/D	Develop TMDLs and implementation plans	The state will support projects which provide for the development of TMDLs and implementation plans which satisfy applicable state, federal, and program regulations and guidance	TMDL and implementation plan development projects	0	0	
ST2/D	Implement TMDLs and implementation plans	The state will support projects which provide for the implementation of management measures specified in TMDLs and implementation plans which satisfy applicable state, federal, and program regulations and guidance	TMDL implementation plan implementation projects	0	5	
ST2/B,C	Load Reductions (Nitrogen)	The state will ensure project reductions are reported utilizing GRTS	GRTS Report	RQ[2]	31,874 lb/yr	Numbers reflect projects with load reductions reported in fiscal year 2017
ST2/B,C	Load Reductions (Phosphorus)	The state will ensure project reductions are reported utilizing GRTS	GRTS Report	RQ[2]	4,265 lb/yr	Numbers reflect projects with load reductions reported in fiscal year 2017

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Texas Nonpoint Source Management Program Milestones *(continued)*

Goals / Objectives	Milestone	Milestone Description	Milestone Measurement	2017[1] Estimate	2017 Actual	Comments
ST2/B,C	Load Reductions (Sediment)	The state will ensure project reductions are reported utilizing GRTS	GRTS Report	RQ[2]	3,725 tons/ yr	Numbers reflect projects with load reductions reported in fiscal year 2017
ST2/E	Effectiveness Monitoring	The state will support projects which provide for the collection and analysis of water quality and other watershed information for the purpose of evaluating the effectiveness of best management practices	Effectiveness monitoring projects	0	9	Numbers reflect active projects

[1] Estimates are from the *2012 Texas Nonpoint Source Management Program* report
[2] RQ – Reportable Quantity

Comal Springs and Landa Lake *(Source: City of New Braunfels)*

www.tceq.texas.gov/publicatons/sfr/sfr-066-17.html

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