

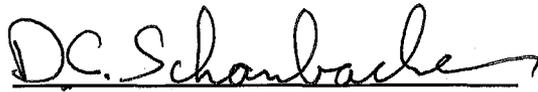
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
AGENDA ITEM REQUEST

AGENDA REQUESTED: July 9, 2008

DATE OF REQUEST: June 20, 2008

**NAME & NUMBER OF PERSON TO CONTACT REGARDING
CHANGES TO THIS REQUEST, IF NEEDED: Suzanne Vargas,
239-4619.**

CAPTION: Docket No. 2008-0250-TML. Consideration for approval
of the final Implementation Plan for one TMDL for dissolved oxygen in
Lake O' the Pines (Segment 0403) of the Cypress Creek Basin, in Camp,
Marion, Morris, and Upshur Counties.
(Faith Hambleton, Marc Friberg)


Chief Engineer

Texas Commission on Environmental Quality

INTEROFFICE MEMORANDUM

To: Commissioners Date: June 20, 2008

Thru: LaDonna Castañuela, Chief
Mark R. Vickery, P. G., Executive Director

From: *MMA for* David C. Schanbacher, P.E., Chief Engineer
Chief Engineer's Office

Subject: Approval of an implementation plan for dissolved oxygen in Lake O' the Pines
Docket ID: 2008-0250-TMDL

Issue Consideration to approve the final total maximum daily load (TMDL) Implementation Plan for dissolved oxygen in Lake O' the Pines (Segment 0403) of the Cypress Creek Basin, in Camp, Marion, Morris, and Upshur Counties.

Background and Current Practice One TMDL for dissolved oxygen in Lake O' the Pines was developed as required by Section 303(d) of the federal Clean Water Act. The commission adopted the TMDL in April 2006, and submitted it to EPA for approval. EPA approved the TMDL in June 2006. The next step in the process was the development of an implementation plan, a flexible tool that the governmental and non-governmental organizations involved in TMDL implementation will use to guide their programs.

The TCEQ has established a process for preparing implementation plans. The process includes opportunity for public input and comment. TCEQ staff prepare a draft implementation plan by coordinating with internal programs, other state agencies, and stakeholders. A key aspect of establishing an effective implementation plan is obtaining input and commitments from other state agencies and stakeholders who have responsibility for implementing control actions and management measures that fall outside of the TCEQ's authority.

Upon completion of the draft implementation plan, TCEQ staff request approval from the commission to solicit public comment and hold a public meeting in the watershed. After the public comment period, TCEQ staff may revise the implementation plan, if appropriate. The implementation plan, combined with the TMDL, provides local, regional, and state organizations with a comprehensive strategy for restoring and maintaining water quality in an impaired water body.

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Attachments

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Arthur Talley, Project Manager

Briefing Outline for Implementation Plan for One Total Maximum Daily Load for Dissolved Oxygen in Lake O' the Pines Segment 0403

I. Introduction

This outline summarizes the draft Implementation Plan (I-Plan) to address low dissolved oxygen levels in Lake O' the Pines. The I-Plan is designed to guide activities that will increase dissolved oxygen levels in the Lake O' the Pines, as defined in the adopted TMDL. The TMDL determined that low dissolved oxygen concentrations in Lake O' the Pines result from *in situ* photosynthesis and respiration and that phosphorus is the limiting nutrient in the reservoir. Analyses of water quality data from the reservoir were used to determine its capacity to assimilate phosphorus loadings. Comparisons of the existing loadings to the reservoir's assimilative capacity determined that a 56% reduction in total phosphorus (TP) loadings is needed to restore water quality conditions in the lake. The location of Lake O' the Pines is illustrated below in Figure 1.

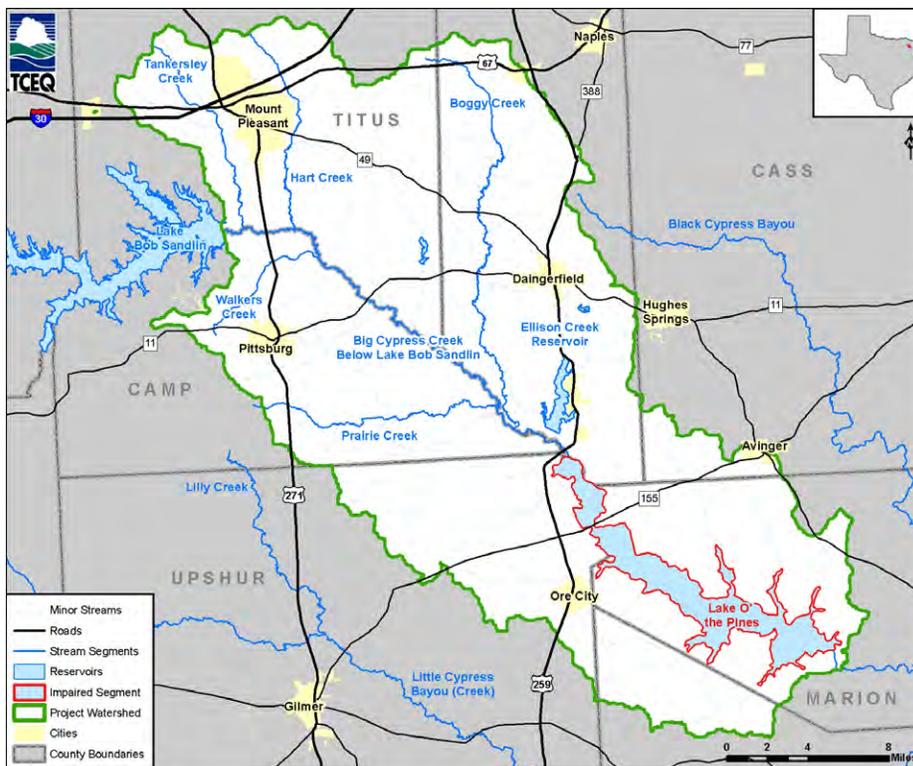


Figure 1. Lake O' the Pines Location Map

A public meeting to take comments on the draft I-Plan for Lake O' the Pines was held at the offices of the Northeast Texas Municipal Water District on April 29, 2008. The meeting was attended by eight persons representing the Texas Parks and Wildlife Department, AEP/SWEPCO, the Texas Farm Bureau, and the Northeast Texas Municipal Water District. An informal overview of the TMDL and draft I-Plan for Lake O' the Pines was presented and informal discussions ensued. Upon completion of the informal portion of the meeting, it was determined that no one in attendance wanted to make formal public comments and the meeting was adjourned.

II. Implementation Strategy

The implementation strategy specifies the actions watershed stakeholders will undertake to achieve water quality standards. The implementation strategy for point sources consists of limiting the discharge of total phosphorus from wastewater discharges through the modification of wastewater discharge permits. The implementation strategy for nonpoint sources consists of continued implementation of technical and financial assistance programs for agricultural producers as well as existing county and local programs for on-site sewage facilities, marine sanitation, and education.

The I-Plan will be implemented using adaptive management concepts and assessment protocols. Adaptive management is a cyclical process in which "priority controls" for water quality improvement are initially identified and implemented. Priority controls are those which have a relatively high level of certainty as to their water quality benefit, relatively low costs, and are otherwise consistent with appropriate management practices in the watershed. The priority controls will be periodically assessed for their achievement of interim and final water quality goals. If periodic assessments find that water quality goals are not being achieved, additional control measures may be required.

A. Point Source Dischargers

The TMDL for dissolved oxygen in Lake O' the Pines specifies a wasteload allocation of 59,500 lb-TP/year (27,000 kg-TP/year) for point source discharges. The TMDL identifies eight point source dischargers in the watershed that contribute significant amounts of total phosphorus to the reservoir. These dischargers will be subject to effluent limits for total phosphorus in their individual permits or as part of a group permit.

A watershed-based group permit is a potentially efficient and cost-effective way to meet the requirement of the TMDL. The group permit would consist of a cooperative agreement among the individual permit holders identified in the TMDL to coordinate their wastewater management activities so as to ensure that the total wasteload allocation for total phosphorus specified in the TMDL is met.

Table 1 presents the wasteload allocation for the point source dischargers in the Lake O' the Pines watershed. Loading allocations were determined by applying the 56% reduction to the existing loadings. The performance measures are to amend and administer permits in accordance with the wasteload allocation set forth in the TMDL.

Table 1. Loading Allocations for Point Source Dischargers in the Lake O' the Pines Watershed

Permit	Permit No.	Flow	Total Phosphorus, Existing			Total Phosphorus, Allocation	
		MGD	mg/l	lb/yr	kg/yr	lb/yr	kg/yr
Pilgrim's Pride Corporation	03017-000	3.00	13.23	121,000	54,900	53,200	24,000
City of Mount Pleasant	10575-004	2.91	0.56	5,000	2,300	2,180	1,000
City of Pittsburg - Sparks Branch	10250-001	2.00	0.664	4,000	1,800	1,780	800
City of Daingerfield	10499-001	0.70	0.54	1,100	500	510	200
City of Lone Star	14365-001	0.44	0.769	1,000	500	450	200
City of Ore City	14389-001	0.22	3.5	2,300	1,000	1,000	400
City of Omaha	10239-001	0.20	0.98	600	300	260	100
City of Pittsburg - Dry Creek	10250-002	0.20	2.14	1,300	600	570	300
Total		9.67	--	136,300	61,900	59,950	27,000

B. Nonpoint Sources

The TMDL for dissolved oxygen in Lake O' the Pines specifies a load allocation of 92,600 lb-TP/year (42,000 kg-TP/year) for anthropogenic nonpoint sources from the watershed.

1) Agriculture

The Texas State Soil and Water Conservation Board (TSSWCB), Soil and Water Conservation Districts (SWCDs), the Natural Resource Conservation Service of the US Department of Agriculture (NRCS), and AgriLife Extension provide conservation planning, technical, and financial assistance to individuals and groups to prevent and abate agricultural nonpoint source pollution in Texas.

Animal Feeding Operations

TSSWCB - Animal feeding operations (AFOs) are agricultural enterprises where animals are kept and raised in confinement. AFOs produce manure that, when improperly managed, can pose a risk to water quality. Animal waste management systems are components of Water Quality Management Plans (WQMPs) for animal

feeding operations. Table 2 summarizes the TSSWCB's WQMP Program for AFOs in the Big Cypress Creek Basin.

Table 2. TSSWCB WQMP Program Summary in the Big Cypress Creek Basin

County	Poultry Operations	Poultry WQMPs	Dairies	Dairy WQMPs	Non-AFO WQMPs	Total WQMPs	WQMP Acreage
TOTAL	105	102	7	5	34	141	17,078

The TSSWCB, in collaboration with the NRCS and the local SWCDs, will continue to provide technical assistance to landowners in developing and implementing WQMPs. The performance measures are:

- Develop and implement WQMPs on 100% of poultry operations in the watershed.
- Develop and implement WQMPs on 85% of dairies in the watershed.
- Develop and implement WQMPs on non-AFO operations in the watershed as appropriate.
- Annually perform status reviews on at least 25% of all WQMPs in the watershed.

TCEQ - The TCEQ administers permits for Concentrated Animal Feeding Operations (CAFOs) and authorizations by rule for non-permitted animal feeding operations under rules in Chapter 321 of Title 30 of the Texas Administrative Code. Table 2 summarizes the TCEQ's related to CAFOs and AFOs program in the Lake O' the Pines watershed.

Table 3. TCEQ Program Summary AFOs in the Lake O' the Pines Watershed

County	Permitted CAFO	Non-Permitted AFO	Total
TOTAL	1	3	4

The performance measures are annual inspections by the TCEQ of all CAFOs and authorized AFOs in the watershed.

Financial Assistance for Agricultural Producers

TSSWCB and NRCS will continue to provide appropriate levels of cost-share assistance to agricultural producers that will facilitate the implementation of BMPs and WQMPs in the Lake O' the Pines watershed.

Agricultural BMP Evaluations

The TSSWCB and the Northeast Texas Municipal Water District (NETMWD) are evaluating the effectiveness of selected best management practices (BMPs) in reducing the nutrient inputs to Big Cypress Creek and Lake O' the Pines.

2) Forestry Operations

The Texas Forest Service (TFS) administers a BMP program focused on minimizing any threats to water quality from forestry activities. The program educates landowners, loggers, and foresters about the threats to water quality and provides technical assistance on how to minimize those threats using non-regulatory forestry BMPs.

3) On-Site Sewage Facilities

In the Lake O' the Pines watershed, local authorities have taken on the responsibility for ensuring that OSSFs in their areas comply with all state requirements. These authorized agents issue approximately 600 OSSF permits and respond to approximately 125 complaints each year.

The NETMWD is completing a project that provided financial support for replacing failing OSSFs in the Cypress Creek Basin through the use of Supplementary Environmental Project funds.

4) Marine Sanitation

NETMWD enforces the TCEQ Boat Sewage Disposal rules within its jurisdiction. The rules prohibit the discharge of waste or sewage from toilet facilities on boats and require boats with toilet facilities to have an approved marine sanitation device.

5) Land Application Sites

There are three permitted land application sites in the Lake O' the Pines watershed. The TCEQ administers the permits and performs regular inspections to ensure compliance with the provisions of the permits.

6) Watershed Educational Activities

The intent of educational outreach activities for the Lake O' the Pines watershed is the promotion of efficient and wise use of phosphorus within the watershed. Education is a primary tool in achieving water quality goals in this watershed. This will be accomplished by maintaining or establishing educational outreach programs for commercial providers of fertilizers, home lawn and garden practices, agricultural producers, homeowners with OSSFs, and forestry operations.

7) Watershed Management Support Activities

Depending upon the results of the initial implementation, tracking and monitoring programs described in this plan, specific plans for additional watershed and water quality modeling may be considered as well as additional characterizations of sediment quality in the reservoir. Also, the TCEQ will consider the creation of a segment between the lower end of Segment 0404 (US 259 crossing of Big Cypress Creek) and the SH 155 crossing of Lake O' the Pines with a dissolved oxygen standard consistent with that in Big Cypress Creek, or a seasonally adjusted standard that recognizes the occurrence of a critical summer period.

III. Implementation Tracking

This I-Plan includes provisions to track the progress of the plan and thus provide information that can be used to determine if progress is being made toward meeting goals of the TMDL. This will allow stakeholders to evaluate actions taken, identify those which may not be working, and make any changes that may be necessary to get the plan back on target.

Implementation Milestones

These are measures of administrative actions undertaken to effect an improvement in water quality. The I-Plan specifies tracking implementation activities in eight general categories: point source discharge permits, AFOs, forestry operations, OSSFs, marine sanitation, land application, and activities that support education and management in the watershed. The information includes a description of the activity, the entity responsible for taking the action, defines a performance measure and goal, and establishes a reporting format and process for tracking these activities over time.

Water Quality Indicators

These are measure of water quality conditions for comparison to pre-existing conditions, constituent loadings, water quality standards, or other appropriate measure.

Phosphorus Loadings - Water quality monitoring will be conducted to determine total phosphorus loadings to Lake O' the Pines. Approximately 80% of the water and 90% of the phosphorus enter Lake O' the Pines through Big Cypress Creek, so monitoring this stream will be sufficient to track the progress of TMDL implementation.

Dissolved Oxygen and Nutrient Monitoring in Lake O' the Pines - Water quality monitoring will be conducted to determine compliance with the state's water quality standards for dissolved oxygen in Lake O' the Pines. Water quality monitoring will also be conducted to monitor total phosphorus, chlorophyll a, and related constituents in Lake O' the Pines.

The monitoring will be accomplished at the two automated stations to be established by NETMWD and the U.S. Army Corps of Engineers and at the TCEQ routine station above the SH 155 causeway. The two automated stations are located in the main pool near the dam and adjacent to the NETMWD intake.

IV. Review Strategy

The results of implementation and water quality tracking activities in the Lake O' the Pines watershed will be reviewed annually by the Lake O' the Pines watershed stakeholders to support decision-making with respect to their evaluation of the adequacy of the I-Plan and its component elements. As part of this evaluation, stakeholders will review implementation activities and the monitoring results to determine if progress is being made toward achieving project goals. Actual results will be compared to goals established in the I-Plan.

Compliance with the wasteload allocation established in the TMDL for point source dischargers will be determined based on a review of annual monitoring reports submitted to the TCEQ.

Compliance with the load allocation established in the TMDL for nonpoint sources in the watershed will be determined by calculating the annual loading of total phosphorus to Lake O' the Pines and subtracting the corresponding loadings from point sources and the estimated background loading.

The nutrient concentrations and dissolved oxygen regimes present in the reservoir will be summarized to characterize seasonal changes, standards compliance, and progress with respect to the TMDL goals.

V. Communication Strategy

Communication is necessary to ensure that stakeholders understand the I-Plan and its progress in restoring water quality conditions. The TCEQ and the TSSWCB will disseminate the information derived from tracking I-Plan activities to interested parties, including watershed stakeholders, state leadership, government agencies, nongovernmental organizations, and individuals.

The TCEQ publishes a report biennially summarizing the status of TMDL projects in the state. This report provides a forum for publicizing the status of individual TMDLs as well as the state's TMDL program. Information derived from tracking and review activities of the I-Plan for Lake O' the Pines will be submitted to the TCEQ for publication in the TMDL Program Status Report.

The TCEQ and the TSSWCB cooperate in the annual publication summarizing the accomplishments of the state's *Nonpoint Source Management Program*. Information derived from tracking and review activities of the I-Plan for Lake O' the Pines will be

submitted for publication in the state's *Annual Report on Managing Nonpoint Source Pollution in Texas*. Both documents are available on the Web at <www.tceq.state.tx.us/nav/eq/nonpointsrcpgm.html>.

Presentations on the results of the tracking and review activities of the I-Plan for Lake O' the Pines will be made to regular meetings of basin stakeholders at the Cypress Creek Basin Clean Rivers Program/Lake O' the Pines TMDL Combined Steering Committee. In addition to meeting presentations, tracking and monitoring results will be posted to a dedicated internet web page and included in water quality publications for the basin.

**Response to Public Comment on
Implementation Plan for TMDL for Dissolved Oxygen in Lake O' the Pines
May 22, 2008**

Tracking Number	Date Recd.	Affiliation of Commenter	Summary of Request or Comment	Summary of TCEQ Action or Explanation
001	5/19/08	Texas State Soil and Water Conservation Board	<p>Comment 1: The commenter recommended using numbers for loadings and allocations as listed in the TMDL document, rather than rounding for use in the I-Plan.</p>	<p>The TCEQ notes that the same metric unit numbers for loadings and allocations are used in both the TMDL document and the I-Plan document. The only difference is that, in the I-Plan, the numbers were presented in both metric and English units rather than just the metric units as was done in the TMDL. English units were added to the I-Plan for informational purposes at the request of watershed stakeholders because English units are used more frequently and are more familiar. No changes to the I-Plan were made as a result of this comment.</p>
			<p>Comments 2 – 26: The commenter recommended changes to text that they had previously provided and other editorial changes to the document.</p>	<p>The document was revised in accordance with the recommendations of the commenter.</p>



Proposed for Commission Approval, July 2008

Implementation Plan for One Total Maximum Daily Load for Dissolved Oxygen in Lake O' the Pines

Segment 0403

Chief Engineer's Office, Water Programs, TMDL Section

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

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TMDL Project Reports are also available on the TCEQ Web site at:
<www.tceq.state.tx.us/implementation/water/tmdl/>

This I-Plan was prepared by the:

- Texas Commission on Environmental Quality,
TMDL Program, Chief Engineer's Office
- Texas State Soil and Water Conservation Board,
Statewide Resource Management Team
- Cypress Creek Basin Clean Rivers Program,
Lake O' the Pines TMDL Combined Steering Committee

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Implementation Plan for One Total Maximum Daily Load for Dissolved Oxygen in Lake O' the Pines

Executive Summary

Lake O' the Pines (Segment 0403) was listed on the state's 303(d) list in 2000 as impaired due to low levels of dissolved oxygen. In accordance with the requirements of Section 303(d) of the federal Clean Water Act, the TCEQ adopted "One Total Maximum Daily Load for Dissolved Oxygen in Lake O' the Pines, Segment 0403" on April 12, 2006 (TCEQ 2006) and the TSSWCB approved the TMDL document on March 23, 2006. U.S. Environmental Protection Agency (EPA) approved the TMDL on June 7, 2006. This implementation plan (I-Plan) is designed to achieve the pollutant reductions identified in the TMDL as necessary to restore dissolved oxygen levels in the water body. The I-Plan was developed through a deliberative process of the Cypress Creek Basin Clean Rivers Program/Lake O' the Pines TMDL Combined Steering Committee.

The TMDL determined that low dissolved oxygen concentrations in Lake O' the Pines result from *in situ* photosynthesis and respiration and that phosphorus is the limiting nutrient in the reservoir. Existing loadings of phosphorus to Lake O' the Pines from point and nonpoint sources were determined through inspection of permits, field sampling, and watershed modeling. Analyses of water quality data from the reservoir were used to determine its capacity to assimilate phosphorus loadings. Comparisons of the existing loadings to the reservoir's assimilative capacity determined that a 56% reduction in phosphorus loadings is needed to restore water quality conditions in the lake.

This I-Plan utilizes an adaptive management approach and includes detailed provisions for implementing priority controls in the watershed. These provisions include a description of the controls, identification of the parties responsible for implementing the controls, a schedule for implementation, the goals associated with the control measures, and a process for tracking, evaluating, and reporting progress. A process of implementation, monitoring, analyses, adaptation, and review ensures that I-Plans will be continually updated. In this way, I-Plans provide a pragmatic and scientifically-based approach to meeting water quality goals within a reasonable time.

The implementation strategies for Lake O' the Pines specify the actions watershed stakeholders will undertake to achieve water quality standards. The implementation strategy for point sources is the limitation of discharges of total phosphorus from wastewater facilities through the modification of wastewater discharge permits. The implementation strategy for nonpoint sources consists of continued implementation of technical and financial assistance programs for agricultural producers, and county and local programs for on-site sewage facilities, marine sanitation, and education.

Activities implemented under this I-Plan will be tracked by the TCEQ through periodic reports from participating entities. The effectiveness of these implementation strategies will be documented through water quality sampling and analyses to verify that the alloca-

tions for total phosphorus specified in the TMDL are met. Progress toward meeting the implementation and water quality goals of the I-Plan will be evaluated through periodic reviews by watershed stakeholders. The I-Plan may be revised by watershed stakeholders based upon their review of progress. I-Plan tracking activities, reviews, and assessments will be published and made available to stakeholders, state leaders, and the public through existing state and local informational materials and outlets.

Introduction

In order to keep Texas' commitment to restore and maintain water quality in impaired rivers, lakes, and bays, the state recognizes that it must establish implementation plans for each TMDL. The TMDL is a technical analysis that:

- determines the amount of a particular pollutant that a water body can receive and still meet applicable water quality standards, and
- estimates how much the pollutant load must be reduced to comply with water quality standards.

This I-Plan is designed to guide activities that will increase dissolved oxygen levels in the Lake O' the Pines, as defined in the adopted TMDL. Governmental and nongovernmental organizations involved in implementation will use the I-Plan to guide their programs' activities to attain water quality standards in Lake O' the Pines. The participating organizations may accomplish the activities described in this I-Plan through rule, order, guidance, or other appropriate formal or informal action.

This I-Plan contains the following components:

- 1) a description of control actions and management measures¹ that will be implemented to achieve the water quality target;
- 2) a schedule for implementing activities to achieve TMDL objectives;
- 3) the legal authority under which the participating agencies may require implementation of the control actions;
- 4) a follow-up tracking and monitoring plan to determine the effectiveness of the control actions and management measures undertaken;
- 5) identification of measurable outcomes and other considerations the TCEQ and stakeholders will use to determine whether the I-Plan has been properly executed, water quality standards are being achieved, or the I-Plan needs to be modified;
- 6) identification of the communication strategies that will be used to disseminate information to stakeholders and other interested parties.

The ultimate goal of the I-Plan is to restore the high aquatic life use designated for Lake O' the Pines by increasing average concentrations of dissolved oxygen, through reductions in phosphorus loadings, to levels that meet the criteria established in the state's

¹ Control actions refer to regulated point source pollutant reduction strategies, generally TPDES permits. Management measures refer to nonpoint source pollutant reduction strategies, generally voluntary best management practices.

water quality standards. The I-Plan was developed through a deliberative process of the Cypress Creek Basin Clean Rivers Program/Lake O' the Pines TMDL Combined Steering Committee. Work groups were formed based on source categories (i.e., wastewater dischargers and agricultural producers) and water quality monitoring needs to identified actions to be taken in response to the TMDL. These actions were then brought together in the required format and reviewed through a peer review process.

In accordance with the *Memorandum of Agreement between the TCEQ and the TSSWCB Regarding TMDLs, I-Plans, and Watershed Protection Plans*, the TSSWCB will consider approval of this I-Plan at a future date. The TSSWCB has primary responsibility for managing programs and practices for the prevention and abatement of nonpoint sources of water pollution originating from agricultural and silvicultural (forestry) activities in Texas. The TCEQ approved the I-Plan on [July 9, 2008]. The TCEQ has primary responsibility for restoring water quality standards in all impaired water bodies in Texas.

Summary of the TMDL

The Lake O' the Pines watershed is part of the 2,812 square mile Cypress Creek Basin, a sub-basin of the Red River drainage located in Northeast Texas between the Sulphur River Basin on the north and the Sabine River Basin to the west and south (see Figure 1). The reservoir was formed with the completion of the Ferrells Bridge Dam in 1959. The reservoir covers an area of approximately 19,000 acres and impounds flow from a drainage basin of approximately 850 square miles. The watershed is an area vegetated primarily by an oak woodland and prairie mosaic.

The watershed includes some of the leading broiler-hen producing counties in the state, accounting for approximately 25% of the broiler production in the state. Timber sales factor heavily in the regional economy, particularly in the eastern portion of the basin. Truck crops (vegetables, fruit, and melons), hay production, and livestock are important throughout the Cypress Creek Basin.

The city of Mount Pleasant, in Titus County, recorded a population of almost 14,000 in the 2000 census, making it the largest urban concentration in the Lake O' the Pines watershed. The cities of Pittsburg, Daingerfield, Lone Star, and Ore City constitute the other major population centers. The total population projected for the Lake O' the Pines watershed in 2050 is 80,808 including estimates of the rural populations in the eleven counties in the watershed, which is an increase of about 37%.

Since 2000, assessments of water quality have consistently identified low dissolved oxygen concentrations in the upper portion of the reservoir. Samples taken at the lower end of the reservoir show a declining trend in dissolved oxygen concentrations. Analyses of the data determined that low dissolved oxygen concentrations in Lake O' the Pines result from *in situ* photosynthesis and respiration and that phosphorus is the limiting nutrient in the reservoir. Dissolved oxygen concentrations as defined by the state's water quality standards are the final endpoint for the TMDL in Lake O' the Pines. However, concentrations of total phosphorus (TP) and chlorophyll-*a* in the reservoir are also used as intermediate water quality targets for the TMDL.

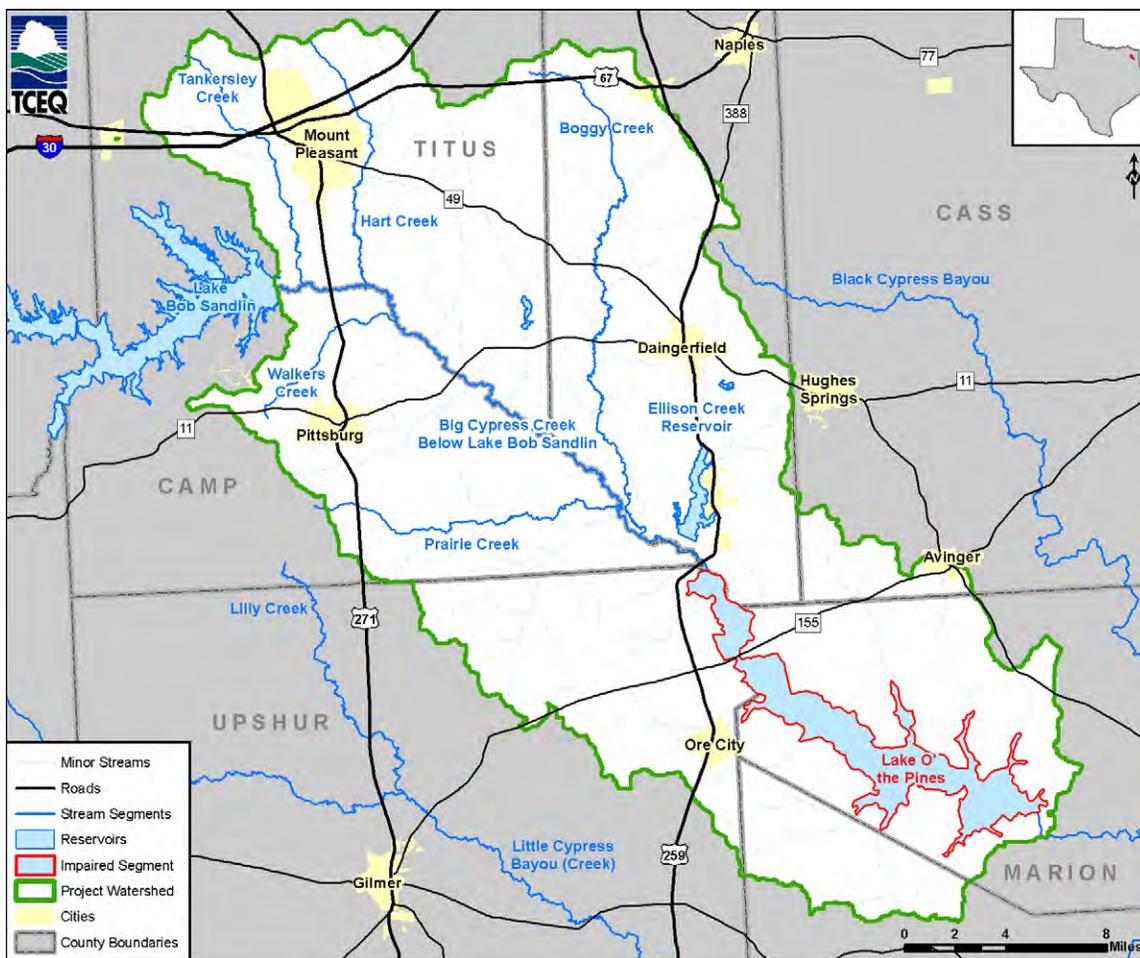


Figure 1. Project Location Map

Existing loadings of total phosphorus and total nitrogen to Lake O' the Pines from point sources were determined through field sampling and maximum permitted discharge rates. Existing loadings of phosphorus and nitrogen to Lake O' the Pines from nonpoint sources were determined by adapting the Soil and Water Assessment Tool (SWAT) model to simulate runoff and watershed loads. The loading rates derived from these analyses are summarized in Table 1.

The relationship of nutrient input to reservoir metabolism is well known, in general. However, nutrient loads do not precisely predict either nutrient levels within the reservoir or their effects on photosynthesis and respiration. Paired values of chlorophyll-*a* and total phosphorus collected at the same stations and dates were employed to directly test their relationships with nutrient levels in Lake O' the Pines. The results showed that the state screening criterion for chlorophyll-*a* (21.4 µg/l) was exceeded only when corresponding total phosphorus concentrations equaled or exceeded 0.07 mg/l. These values are the intermediate water quality targets for the TMDL.

To establish a quantitative relationship between phosphorus loading and concentrations in Lake O' the Pines, the empirical model developed by Vollenweider was employed to re-

late landscape loading to reservoir total phosphorus concentration (Cooke, et al, 1993). To minimize the probability of algal blooms (either planktonic or periphytic), it is necessary to reduce the average total phosphorus concentration in the reservoir to below 0.07 mg/l. Solving the Vollenweider model for the appropriate load gives 192,000 lb/year (87,200 kg/year).

Table 1. Existing Nutrient Loadings to Lake O' the Pines

Source Category	Total Phosphorus		Total Nitrogen	
	lb/year	kg/year	lb/year	kg/year
Point Sources	136,500	61,900	580,000	263,000
Nonpoint Sources	209,000	94,800	269,000	122,000
Total Anthropogenic Sources	345,500	156,700	849,000	385,000
Background Nonpoint Sources	40,000	18,200	166,000	75,400
All Sources	385,500	174,900	1,015,000	460,400

Thus, the allowable loading of total phosphorus to Lake O' the Pines under the TMDL is calculated to be approximately 192,000 lb/year (87,200 kg/year). Of this amount, 40,000 lb/year (18,200 kg/year) is estimated to be the background nonpoint source load. This leaves 152,000 lb/year (69,000 kg/year) of total phosphorus available to be allocated to anthropogenic point and nonpoint sources in the watershed, an approximate 56% reduction in the existing loadings to the reservoir. Reducing the existing loadings by 56% yields allowable loadings for point sources and nonpoint sources as approximately 59,500 lb/year (27,000 kg/year) and 92,600 lb/year (42,000 kg/year) respectively.

Implementation Strategy

The implementation strategy describes the actions that stakeholders in the watershed will undertake to achieve water quality standards in Lake O' the Pines. The strategy specifies the actions believed to be necessary to meet the pollutant load allocations assigned to point sources and nonpoint sources identified in the TMDL. The specific actions were selected from a menu of possible measures based on an evaluation of feasibility, costs, effectiveness, support, timing, and other factors.

The implementation strategy for point sources is limitation of the discharge of total phosphorus from wastewater facilities identified in the TMDL through the modification of their existing wastewater discharge permits. The implementation strategy for nonpoint sources includes continued implementation of technical and financial assistance programs

for agricultural producers, and existing state, county and local programs for forestry, on-site sewage systems, marine sanitation, land application, and education.

The TCEQ and the TSSWCB will track implementation activities through periodic performance measure reports from participating entities. The effectiveness of these implementation activities will be documented through water quality sampling and analyses to verify that the allocations for total phosphorus specified in the TMDL are met and that dissolved oxygen levels are responding as expected. Progress toward meeting the goals of the I-Plan will be evaluated through periodic reviews by watershed stakeholders. The watershed stakeholders may revise the I-Plan based upon these reviews and other pertinent information available. The results of the I-Plan tracking activities, reviews, and assessments will be published and made available to the public through existing state and local informational materials and outlets.

Adaptive Implementation

This I-Plan will be implemented using adaptive management concepts and assessment protocols. The adaptive management approach to implementing TMDLs was first presented in the congressionally authorized report of the National Research Council (NRC) in 2001, which assessed the scientific basis for the nation's TMDL program. The NRC committee concluded that "uncertainty in TMDL forecasts was/is often large, with the consequence that implementation actions for water quality improvement might be ineffective and therefore wasteful of resources" (Reckhow, 2007). The NRC committee recommended adaptive management as a way to both begin addressing water quality problems while continuing to conduct scientific assessments designed to reduce these uncertainties. Adaptive management is described as a "learning while doing" approach.

Adaptive management is a cyclical process in which priority controls for water quality improvement are initially identified and implemented. Priority controls are those which have a relatively high level of certainty in their benefits to water quality, relatively low costs, and are otherwise consistent with appropriate management practices in the watershed. Priority controls may be sufficient to resolve the water quality impairment, or, in more challenging situations, may only be sufficient to "move the watershed's water quality in the direction of reducing pollutant loads" (Shabman, L., et al, 2007). The degree of effectiveness of priority controls depends upon the level of certainty regarding understanding of watershed processes, the magnitude of the water quality problems, and other factors.

The adaptive management approach specifies that water quality control measures be periodically assessed for their achievement of interim and final water quality goals. The final water quality goal of a TMDL is attainment of the water quality standard. Interim water quality goals are a series of water quality-based milestones that together form a progression toward meeting the water quality standards. If periodic assessments find that water quality goals are not being achieved, additional control measures may be required. These additional control measures may require further evaluation prior to being deployed in the watershed. These evaluations are to be included in the on-going assessments designed to improve our overall understanding of the watershed.

Control Actions for Point Source Dischargers

The TMDL for dissolved oxygen in Lake O' the Pines specifies a wasteload allocation of 59,500 lb-TP/year (27,000 kg-TP/year) for point source discharges. The TMDL further identifies eight point-source dischargers in the watershed that contribute significant amounts of total phosphorus to the reservoir and thus contribute to the low dissolved oxygen levels which have been observed. The control actions described in this I-Plan are designed to meet the wasteload allocations specified in the approved TMDL.

Discussions among stakeholders in the watershed have determined that a potentially efficient and cost-effective way to meet the requirement of the TMDL is a watershed-based permitting approach. Guidance on watershed-based permitting is provided by the EPA (USEPA 2003). The watershed-based approach consists of a cooperative agreement among the individual permit holders identified in the TMDL to coordinate their wastewater management activities to ensure that the total wasteload allocation for total phosphorus specified in the TMDL is met. The TCEQ's water quality program has not previously issued a permit of this nature. However, this approach is consistent with TCEQ and EPA policies designed to promote the achievement of environmental goals in a cost-effective manner.

The approach includes opportunities and mechanisms for water quality trading. Water quality trading is described by the EPA as a situation in which sources in a watershed face different costs to control the same pollutant. Trading programs allow facilities facing higher pollution control costs to meet their regulatory obligations by obtaining environmentally equivalent pollution reductions from another source in the watershed, thus achieving the same water quality objective at lower overall costs. Circumstances in the Lake O' the Pines watershed are well suited to take advantage of these cost efficiencies.

The cooperative agreement for the watershed-based, point source management strategy in the Lake O' the Pines watershed will be administered by either:

- a non-profit association to be established by point source dischargers in the watershed, or
- an existing authority such as a water district, river authority, or other subdivision of the state.

The administrating organization will seek permit coverage from dischargers for the constituents covered by the TMDL in a watershed-based group permit with multiple co-permittees. The permit will establish a combined phosphorus limit that meets the wasteload allocation for phosphorus established in the TMDL. The dischargers will be subject to compliance limits for total phosphorus in a group TPDES permit, rather than in the individual TPDES permits that would otherwise be required. The administrating organization will serve as the point of contact between the TCEQ and the co-permittees on issues related to the group permit. The group permit will be issued under existing authorities of the TCEQ. Participation in the group permit will be voluntary. Dischargers that choose not to participate in the group permit will be subject to effluent limits for total phosphorus in their individual permits, and the total phosphorus limit in the group permit will be reduced accordingly.

Funding for the sources described in Table 2 below will come from a mix of private and public sources. The state does not anticipate that any new sources of federal funding will be needed to implement these control actions beyond those currently used to support state and federal wastewater permitting programs. Additional sources of technical assistance will not be needed to implement these control actions.

Control Action PS 1 - Establish Entity Responsible for Group Permit

Of the eight point source dischargers identified in the TMDL for Lake O' the Pines, those that choose to participate will collectively establish an entity responsible for a group permit to cover the discharge of total phosphorus in accordance with the limits established in the TMDL. The entity responsible for the group permit may be a new non-profit association or an existing authority such as a water district, river authority, or other subdivision of the state. The dischargers that may participate in the group permit are listed in Table 2.

Table 2. Potential Participants in the Group Permit

Permit Holder	Permit Number	Permit Holder	Permit Number
Pilgrim's Pride Corporation	03017-000	City of Daingerfield	10499-001
City of Mount Pleasant	10575-004	City of Lone Star	14365-001
City of Pittsburg - Sparks Branch	10250-001	City of Ore City	14389-001
City of Pittsburg - Dry Creek	10250-002	City of Omaha	10239-001

An association established for this purpose must be a non-profit organization recognized under Texas law. The administering organization, whether a non-profit formed specifically for the purpose or an existing governmental organization, will adopt or amend by-laws, policies, and/or procedures that enable it to serve as administrator for the group permit. These policies and procedures are subject to approval by the TCEQ before a group permit will be issued.

The administrator of the group permit will:

- establish and track limits on the discharge of total phosphorus of its member organizations
- provide the mechanisms for phosphorus trading between member organizations to ensure that they collectively meet the phosphorus limit established in the TMDL; and
- be responsible for ensuring that compliance monitoring is conducted, compiling these monitoring results, and submitting reports to the TCEQ in accordance with the terms of the group permit.

The performance measure for this action is the establishment of an administrator responsible for the group permit within one year of the approval of the I-Plan by the TCEQ.

Control Action PS 2 - Permitting

The administrator for the group permit, the TCEQ, and individual permit holders will obtain permit coverage for the discharge of total phosphorus in the Lake O' the Pines watershed in compliance with the wasteload allocation specified in the TMDL. Table 3 lists the dischargers, their existing loadings for total phosphorus as presented in the TMDL, and the loading allocation established for each discharger under the implementation plan. Loading allocations were determined by applying the 56% reduction to the existing loadings.

Table 3. Loading Allocations for Point Source Dischargers in the Lake O' the Pines Watershed

Permit	Permit No.	Permitted Flow	Total Phosphorus	Total Phosphorus, Existing		Total Phosphorus, Allocation	
		MGD	mg/l	lb/yr	kg/yr	lb/yr	kg/yr
Pilgrim's Pride Corporation	03017-000	3.00	13.23	121,000	54,900	53,200	24,000
City of Mount Pleasant	10575-004	2.91	0.56	5,000	2,300	2,180	1,000
City of Pittsburg – Sparks Branch	10250-001	2.00	0.664	4,000	1,800	1,780	800
City of Daingerfield	10499-001	0.70	0.54	1,100	500	510	200
City of Lone Star	14365-001	0.44	0.769	1,000	500	450	200
City of Ore City	14389-001	0.22	3.5	2,300	1,000	1,000	400
City of Omaha	10239-001	0.20	0.98	600	300	260	100
City of Pittsburg – Dry Creek	10250-002	0.20	2.14	1,300	600	570	300
Total		9.67	--	136,300	61,900	59,950	27,000

Control Action PS 2.1 - Amend Existing Industrial Permit

The wastewater discharge permit held by Pilgrims Pride Corp. (Permit No. 03017-000) will be amended to establish a limit on the discharge of total phosphorus in accordance with the loading allocation presented above in Table 3 if the permittee does not participate in the group permit. The permit amendment process will follow standard operating procedures of the TCEQ.

The performance measures for this action are as follows.

- PS 2.1-a) Pilgrim's Pride Corp. will submit an application for permit amendment within one year of the approval of the I-Plan by the TCEQ and
- PS 2.1-b) The TCEQ will seek to propose the amended permit for public notice within one year of the receipt of the permit amendment application.

Control Action PS 2.2 - Amend Existing Municipal Permits

TCEQ will recall the permits of municipal wastewater dischargers that choose not to participate in the group permit. These permits will be amended to establish limits on the discharge of total phosphorus in accordance with the loading allocation presented in Table 3. The permit amendment process will follow standard operating procedures of the TCEQ.

The performance measures for this action are as follows.

- PS 2.2-a) The TCEQ will seek to recall the municipal discharge permits of the facilities that choose not to participate in the group permit for amendment within two years of the approval of the I-Plan by the TCEQ.
- PS 2.2-b) The TCEQ will seek to propose the amended permits for public notice within one year of the date the individual permits are called in by the TCEQ.

Control Action PS 2.3 - Issue Group Permit

The administrator for the group permit will submit an application for the permit to the TCEQ. The application will be for coverage under a watershed-based group permit with multiple co-permittees. The co-permittees that could be covered by the permit are identified above in Table 2. The co-permittees will be subject to total phosphorus limits in the group's TPDES permit, rather than in their individual TPDES permits. The TCEQ will review the permit application according to its standard operating procedures.

Each co-permittee to the group permit has an allocation for total phosphorus. The association's total phosphorus limit for a given calendar year is equal to the wasteload allocation established in the TMDL. This overall allocation for total phosphorus is the sum of all allocations for the co-permittees to the group permit. The allocations of co-permittee members may change due to purchases, sales, trades, leases, and other transactions among members. The administrator will track and provide accounting for all transactions conducted among the co-permittees and will report this information in accordance with permit requirements.

Requirements in the group permit will supplement the requirements contained in each member's individual permit. The group permit governs only discharges of total phosphorus. The requirements under each discharger's individual permit remain in effect. The group permit will replace requirements of an individual permit only where specifically stated.

The performance measures are as follows.

- PS 2.3-a) The administrator for the group permit will submit an application for the permit to the TCEQ within two years of the approval of the I-Plan by the TCEQ.
- PS 2.3-b) The TCEQ will seek to propose the group permit for public notice within one year of the receipt of the permit application.

Control Action PS 3 - Permit Implementation

The participants in the group permit and holders of individual permits with limitations on total phosphorus will monitor their discharge loadings of total phosphorus and report this information to the TCEQ on a monthly basis. Permit holders will be considered in compliance with their permits if they comply with their respective permit limits for total phosphorus during each calendar year. If the total for the group permit or an individual permit exceeds the permitted limit for the discharge of total phosphorus for a calendar year, the exceedance will be addressed through the compliance and enforcement procedures of the TCEQ.

Permit holders will monitor discharges of total phosphorus and report results to TCEQ as specified in their individual or group permits. The administrator for the group permit will compile and submit co-permittee members' total phosphorus monitoring results for its own reporting purposes. The entity will serve as the primary point of contact between the co-permittee members and TCEQ, including preparation and submission of information such as reports and requests for modification or renewal of the group compliance permit. Participants in the group permit will submit an Annual Report. The Annual Report will summarize discharges for the group and each co-permittee member, as well as transactions made during the previous calendar year that effect total phosphorus allocations. Similarly, holders of individual permits with limitations on total phosphorus monitor discharges of total phosphorus and report results to TCEQ as specified in their permits.

The performance measure by which this action will be evaluated will be compliance with limitations on the discharge of total phosphorus by individual and group permittees in the watershed. Attainment of the goal will be determined by an evaluation of reports submitted to the TCEQ and other compliance documentation that might be available. It is the goal of this action that permittees will be in compliance with their permit limitations within three years of the issuance of new and amended permits.

Management Measures for Nonpoint Sources

The TMDL for dissolved oxygen in Lake O' the Pines specifies a load allocation of 92,600 lb-TP/year (42,000 kg-TP/year) for anthropogenic nonpoint sources from the watershed. The TMDL identifies the subcategories of nonpoint source pollution believed to contribute total phosphorus to the reservoir. The TCEQ and the TSSWCB expect that the management measures for nonpoint sources described in this I-Plan will be sufficient to meet the load allocations specified in the approved TMDL.

Management Measures for Agriculture

Management measures implemented at agricultural operations will include operation-specific water quality management plans (WQMPs), technical and financial assistance, and education.

Implementing Agencies for Agricultural Measures

The governmental agencies listed below will be responsible for implementing management measures aimed at reducing nonpoint source loadings from agricultural operations. Their duties and activities related to this I-Plan are described in the following sections.

Texas State Soil and Water Conservation Board

The TSSWCB is the lead agency in Texas responsible for planning, implementing and managing programs and practices for preventing and abating agricultural and silvicultural (forestry) nonpoint source pollution (Texas Agriculture Code Section 201.026). In accordance with this responsibility, the TSSWCB administers a certified Water Quality Management Plan (WQMP) Program that provides, through local soil and water conservation districts (SWCDs), for the development, implementation, and monitoring of individual WQMPs for agricultural and silvicultural lands. Each WQMP is developed, maintained, and implemented under rules and criteria adopted by the TSSWCB. A WQMP achieves a level of pollution prevention or abatement consistent with the state's water quality standards.

A WQMP is a site-specific plan designed to assist landowners in managing nonpoint source pollution from agricultural and silvicultural activities. WQMPs are traditional conservation plans based on the criteria outlined in the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) Field Office Technical Guide (FOTG). The FOTG represents the best available technology and is tailored to meet local needs. A WQMP includes appropriate land treatment practices, production practices, management measures, technologies, or combinations thereof. WQMPs are developed in cooperation with the landowner with assistance from the NRCS and approved by the local SWCD and are certified by the TSSWCB. This approach to preventing and abating nonpoint source pollution uses a voluntary approach while affording the landowner a mechanism for compliance with the state's water quality standards.

The TSSWCB regularly performs status reviews on WQMPs to ensure that the producer is implementing the measures prescribed in the WQMP. The TSSWCB administers technical and cost-share assistance programs to assist producers in implementing their WQMPs. The TSSWCB utilizes both state appropriations and federal grants to fund the WQMP Program.

Soil and Water Conservation Districts

An SWCD, like a county or school district, is a subdivision of state government. SWCDs are administered by a board of five directors who are elected by their fellow landowners. There are currently 217 individual SWCDs organized in Texas. Through decades old agreements, SWCDs offer agricultural landowners and operators technical assistance through a partnership with the NRCS and the TSSWCB. It is through this conservation partnership that local SWCDs are able to furnish technical assistance to farmers and

ranchers in the preparation of a complete soil and water conservation plan to meet each land unit's specific capabilities and needs. The SWCDs that are active in the Lake O' the Pines watershed are shown in Table 4.

Table 4. SWCDs in the Lake O' the Pines Watershed

SWCD	Counties within SWCD
Harrison County SWCD #412	Harrison
Upshur-Gregg SWCD #417	Upshur, Gregg
Sulphur-Cypress SWCD #419	Franklin, Titus, Morris, Camp
Marion-Cass SWCD #433	Cass, Marion

USDA Natural Resources Conservation Service

The NRCS is a federal agency that works hand-in-hand with Texans to improve and protect their soil, water and other natural resources. For decades, private landowners have voluntarily worked with NRCS specialists to prevent erosion, improve water quality, and promote sustainable agriculture.

The NRCS provides conservation planning and technical assistance to landowners, groups, and units of government to develop and implement conservation plans that protect, conserve, and enhance their natural resources. When providing assistance, NRCS focuses on the sound use and management of soil, water, air, plant, and animal resources. NRCS helps customers manage their resources in a way that prevents resource degradation, ensures sustainability, allows for productivity, and respects the customers' needs. Conservation planning can make improvements to livestock operations, crop production, soil quality, water quality, and pastureland, forestland, and wildlife habitats. The NRCS also integrates ecological and economic considerations in order to address private and public concerns.

The NRCS administers numerous Farm Bill Programs authorized by the U.S. Congress that provide financial assistance for many conservation activities:

- Conservation Innovation Grants (CIG)
- Conservation Security Program (CSP)
- Environmental Quality Incentives Program (EQIP)
- Farm and Ranch Lands Protection Program (FRPP)
- Grassland Reserve Program (GRP)
- Wetlands Reserve Program (WRP)
- Wildlife Habitat Incentives Program (WHIP)

EQIP was reauthorized in the federal Farm Security and Rural Investment Act of 2002 (Farm Bill) to provide a voluntary conservation program for farmers and ranchers that promotes agricultural production and environmental quality as compatible national goals. People who are engaged in livestock or agricultural production on eligible land may participate in the EQIP program. EQIP offers financial and technical assistance to eligible

participants for installation or implementation of structural and management practices on eligible agricultural land. EQIP also provides incentive and cost-share payments to implement conservation practices. EQIP activities are carried out according to a plan of operations developed in conjunction with the producer that identifies the appropriate conservation practice(s) to address resource concerns. All practices are subject to NRCS technical standards described in the FOTG and adapted for local conditions. The local SWCD approves the plan.

Texas AgriLife Extension Service

AgriLife Extension, an agency of the Texas A&M University System, provides quality, relevant, outreach and continuing education programs and services to Texans. AgriLife Extension serves every county in Texas; its information is provided by scientists and researchers at Texas A&M and other universities, and is made practical and relevant by Extension educators or agents who work in each county. AgriLife Extension continually assesses and responds to educational needs identified by community residents, advisory committee members, volunteers, stakeholder groups, and representatives of organizations and agencies. Extension education encompasses the broad areas of agriculture and natural resources, community economic development, family and consumer sciences, and youth development programs such as 4-H. Among other goals and priority objectives pursued by AgriLife Extension, the following relate to agriculture and natural resources.

- Consumers, homeowners, agricultural producers, communities, and irrigation districts understand and adopt best management practices to protect water quality and enhance conservation so water supplies will meet future water needs in Texas that are essential for expanding agricultural growth, jobs, and the economy in both rural and urban areas.
- Landowners, professional ecosystem managers, community planners, and other interest groups become more knowledgeable, make informed decisions, and adopt best management practices that insure the proper management of rural and urban natural ecosystem resources (rangeland and forestry, etc.) through stewardship education in order to support the biological, sociological, and economic sustainability of those resources.
- Advance the planning and management of natural resource-based recreation opportunities in Texas.
- Through pesticide safety education, licensed and unlicensed pesticide users (including farmers, ranchers, pest control businesses, and the general public) will understand and adopt safer pesticide and non-chemical management methods for managing pests and will be able to continue their pursuit of business enterprises and employment.

Management Measure AG 1 – Animal Feeding Operations

Animal feeding operations (AFOs) are agricultural enterprises where animals are kept and raised in confinement. AFOs produce manure that, when improperly managed, can pose a risk to water quality. The TSSWCB, NRCS, AgriLife Extension, TCEQ, and other state and federal agencies are committed to a comprehensive approach to ensure that manure and wastewater from AFOs are properly managed. This approach includes a

comprehensive suite of voluntary programs and regulatory programs to ensure that AFOs establish appropriate site-specific nutrient management practices that will protect water quality.

Management Measure AG 1.1 - TSSWCB WQMP Program

Several essential practices from the NRCS FOTG included in a WQMP are of specific applicability to the phosphorus allocations of this TMDL. Nutrient management must be outlined if nutrients, such as commercial fertilizer, are applied. If an animal feeding operation is involved, such as a dairy or poultry operation, an animal waste management system will be a component of the WQMP. Waste utilization will be taken into account when agricultural wastes like poultry litter or dairy manure are land applied. Certain poultry facilities in Texas must operate in accordance with a WQMP certified by the TSSWCB (Texas Water Code §26.302). Each poultry producer must have requested development of a WQMP from their SWCD according to a schedule of deadlines depending on their initial date of operation.

Table 5 summarizes the TSSWCB's WQMP Program for AFOs in the Big Cypress Creek Basin. It describes the number of known poultry operations and dairies by county, the associated number of certified WQMPs on poultry operations, dairies, and non-AFO agricultural operations, and the total number of acres under certified WQMPs.

Table 5. TSSWCB WQMP Program Summary in the Big Cypress Creek Basin

County	Poultry Operations	Poultry WQMPs	Dairies	Dairy WQMPs	Non-AFO WQMPs	Total WQMPs	WQMP Acreage
Camp	67	64	6	5	12	81	7,051
Morris	14	14	1	-	13	27	5,424
Titus	23	23	-	-	8	31	4,287
Upshur	1	1	-	-	1	2	316
TOTAL	105	102	7	5	34	141	17,078

The TSSWCB, in collaboration with the NRCS and the local SWCDs, will continue to provide technical assistance to landowners in developing and implementing WQMPs. The performance measures for AG 1.1 are:

- AG 1.1-a) Develop and implement WQMPs on 100% of poultry operations in the watershed.
- AG 1.1-b) Develop and implement WQMPs on 85% of dairies in the watershed.
- AG 1.1-c) Develop and implement WQMPs on non-AFO operations in the watershed as appropriate.

AG 1.1-d) Annually perform status reviews on at least 25% of all WQMPs in the watershed.

The existing TSSWCB WQMP Program for AFOs is funded through state appropriations. It is not anticipated that any new sources of funding will be required to implement this management measure.

Management Measure AG 1.2 - TCEQ Agriculture Permits and Authorizations

The TCEQ administers permits for Concentrated Animal Feeding Operations (CAFOs) and authorizations by rule for non-permitted animal feeding operations under rules in Chapter 321 of Title 30 of the Texas Administrative Code. Table 6 summarizes the TCEQ's program related to CAFOs and AFOs program in the Lake O' the Pines watershed.

Animal feeding operations that meet the definition of a CAFO are required to obtain a permit from the TCEQ. The permit establishes requirements for control facilities, nutrient management plans, buffers, sampling, record-keeping, and reporting. The TCEQ performs regular inspections to ensure compliance with the provisions of the permits.

Table 6. TCEQ Program Summary AFOs in the Lake O' the Pines Watershed

County	Permitted CAFO	Non-Permitted AFO	Total
Camp	1	2	3
Morris	-	1	1
TOTAL	1	3	4

AFOs, which do not meet the definition of a CAFO and that do not obtain a certified WQMP from the TSSWCB, may operate as facilities authorized under TCEQ rules. These rules, which are not permits, specify requirements for control structures, operation and maintenance, land application, soil testing, nutrient utilization plans, record keeping, and inspections. The TCEQ inspects authorized AFO facilities to ensure compliance with state rules. The TCEQ, in collaboration with the TSSWCB and the NRCS, provides technical assistance to individual operators of AFOs within its jurisdiction as needed. The TCEQ will inspect all permitted CAFOs and all authorized AFOs annually. The TCEQ program for AFOs is funded through existing state appropriations and continuing federal grants. The TCEQ does not anticipate that any new sources of funding will be required to implement these activities. The performance measure for AG 1.2 is annual inspections by the TCEQ of all CAFOs and authorized AFOs in the watershed.

Management Measure AG 2 - Financial Assistance

TSSWCB and NRCS will continue to provide appropriate levels of cost-share assistance to agricultural producers that will facilitate the implementation of BMPs and WQMPs in the Lake O' the Pines watershed.

Since the beginning of the TSSWCB WQMP Program in 1995, cost-share has been obligated by SWCDs to producers within the Big Cypress Creek Basin to assist them in implementing the BMPs prescribed in their WQMPs. In FY2008, just over \$81,000 in state appropriations was allocated by the TSSWCB to Sulphur-Cypress SWCD #419, Upshur-Gregg SWCD #417, and Marion-Cass SWCD #433. These SWCDs include areas outside of the Lake O' the Pines watershed. The TSSWCB expects to continue this level of cost-share funding into the foreseeable future, depending on appropriations from the Texas Legislature.

During the period of October 1999 through July 2002, technical and cost-share assistance for agricultural producers in the Lake O' the Pines watershed was funded by a Clean Water Act Section 319(h) grant from the TSSWCB. Technical assistance resulted in the certification of 70 WQMPs and cost-share assistance of \$139,858 was provided to 28 agricultural producers to assist them in installing planned best management practices. There are no plans to seek additional funding of this nature in the foreseeable future since current state appropriations are adequate to meet cost-share assistance needs.

The USDA NRCS EQIP State Resource Concern for Water Quality/Air Quality for AFO-CAFO Poultry is directed toward protection of streams affected by runoff from poultry operations. Eligible practices include nutrient management, waste storage facility, filter strips, field border, riparian forest buffer, pasture and hayland planting, and range planting. Poultry operations within a watershed listed for bacteria or dissolved oxygen on the 303(d) List (such as Lake O' the Pines) would receive a higher ranking for funding. Additionally, each county in the Lake O' the Pines watershed received an EQIP allocation of \$144,000 in FY 2008. These counties include areas outside of the Lake O' the Pines watershed. It is anticipated this level of cost-share funding will continue in the future depending on reauthorization of the Farm Bill and future Congressional appropriations. More information on the EQIP program may be found at the following Web at: <www.tx.nrcs.usda.gov/programs/EQIP/index.html>.

Performance measures for AG-2 are continued financial assistance from the:

- AG 2-a) TSSWCB WQMP Program
- AG 2-b) NRCS EQIP Program.

Management Measure AG 3 - BMP Evaluations

Through a federal Clean Water Act §319(h) grant from the TSSWCB, the Northeast Texas Municipal Water District (NETMWD) is evaluating the effectiveness of selected BMPs in reducing the nutrient inputs to Big Cypress Creek and Lake O' the Pines by documenting runoff water quality from sites representing the dominant soil and land use types, with and without management practices implemented. This project utilizes surface water quality monitoring and SWAT modeling. The project is currently scheduled to end

March 31, 2009. The project work plan and approved Quality Assurance Project Plan are available at: <www.tsswcb.state.tx.us/managementprogram/cypress>. The performance measure for AG 3 is a final project report from the NETMWD and TSSWCB that documents the cumulative effect of implemented WQMPs in the Lake O' the Pines watershed.

Management Measures for Forestry Operations

The Texas Forest Service (TFS), an integral part of The Texas A&M University System, is mandated to assume direction of all forest interests and all matters pertaining to forestry within Texas. TFS administers a BMP program focused on minimizing any threats to water quality from forestry activities. The program educates landowners, loggers, and foresters about the threats to water quality and provides technical assistance on how to minimize those threats using non-regulatory forestry BMPs.

Forestry BMPs are a set of guidelines that involve the application of conservation practices that effectively prevent or minimize the amount of nonpoint source pollution generated during forestry operations. TFS, in collaboration with the TSSWCB and the Texas Forestry Association, publishes a handbook of *Texas Forestry BMPs*. The handbook includes guidelines relating to planning, road construction, and maintenance, harvesting operations, locations of landings, skid trails, drainage, treatment of wastes and chemicals and the protection of stream courses. The handbook is available at: <<http://txforestsERVICE.tamu.edu/uploadedFiles/Sustainable/bmp/bmpbookindd.pdf>>.

TFS monitors BMP implementation throughout the state. Every three years, TFS publishes a report, *Voluntary Implementation of Forestry Best Management Practices in East Texas*, which describes the level at which BMPs are being implemented. The reports are available on the TFS Web site at <<http://txforestsERVICE.tamu.edu/main/article.aspx?id=74&terms=publications>>.

Management Measure FO 1 - BMP Evaluations

Through a federal Clean Water Act Section 319(h) grant from the TSSWCB, TFS evaluated voluntary implementation of forestry BMPs in East Texas. The most recent round of implementation monitoring concluded that on the sites monitored in the Cypress Creek Basin, overall BMP implementation was 88.8%. The report concluded that implementation was statistically higher when the landowner was familiar with BMPs and the logging contractor had attended formal BMP training. Additionally, major improvements from previous rounds of implementation monitoring included a decrease in the number of significant risks to water quality. The next round of BMP implementation monitoring is scheduled to be completed in 2008. It will evaluate BMP implementation at approximately 150 logging sites throughout East Texas. The evaluation includes areas outside of the Lake O' the Pines watershed. The report is available at: <<http://txforestsERVICE.tamu.edu/uploadedfiles/sustainable/bmp/round6.pdf>>.

Also through Clean Water Act Section 319(h) grants from the TSSWCB, TFS is evaluating effectiveness of silvicultural BMPs on sites under intensive forest management. Surface water quality monitoring and biological community data is being collected above and below the forestry operation, as well as before and after treatment. The project is cur-

rently scheduled to end August 31, 2008 and results will provide a determination of the effectiveness of forestry BMPs in protecting water quality. The project work plan and approved quality assurance project plan are available at: <www.tsswcb.state.tx.us/managementprogram/txsilvbmp>.

The TSSWCB will continue to support TFS implementation monitoring, technical assistance and education initiatives (discussed later) through Clean Water Act Section 319(h) grants. The cost of these programs for the fiscal years 2006 through 2008 was approximately \$950,000 and covered 38 counties in East Texas.

The TSSWCB anticipates that a similar level of funding will be requested for this program in future years. The performance measure for FO1 is BMP evaluation by the TFS at 150 sites over 3 years (not all sites are within the Lake O' the Pines watershed).

Management Measure FO 2 - Technical Assistance

TFS will continue to provide technical assistance to landowners, loggers, and foresters, including conducting BMP training workshops. These workshops provide attendees with practical information regarding the proper application of best management practices. The TFS conducts three BMP training workshops per year at sites throughout East Texas.

TFS personnel provide technical assistance to numerous individual forest landowners through phone conversations, email, and site visits. Forest stewardship plans are developed for landowners and include relevant, site-specific information regarding the protection of water quality through the use of forestry BMPs. The Tree Farm Program, a voluntary certification program designed to encourage sustainable forest management and BMPs, is also promoted to forest landowners.

The technical assistance project includes areas outside of the Lake O' the Pines watershed. The performance measure for FO2 is training workshops conducted by TFS three times yearly.

Management Measures for On-Site Sewage Facilities

On-site sewage facilities (OSSF) treat sewage from homes and businesses that are not connected to a centralized wastewater treatment plant. Nearly one in four households in the United States depends on OSSF to treat wastewater. It is estimated that 40% of new development in the United States will utilize OSSF. EPA concluded in its 1997 Report to Congress that "adequately managed decentralized wastewater systems are a cost-effective and long-term option for meeting public health and water quality goals, particularly in less densely populated areas." In far too many cases, however, OSSFs are installed and largely forgotten - until problems arise. The U.S. Bureau of the Census has indicated that at least 10% of on-site systems have stopped working, and some communities report failure rates as high as 70%. Failing OSSFs can be a significant source of pathogens and nutrients to surface and ground waters.

The difference between failure and success is the implementation of an effective wastewater management program. Such a program, if properly executed, can protect public health, preserve valuable water resources, and maintain economic vitality in a community. Almost all OSSFs in Texas must have a permit prior to any construction, installation, repair, extension, or other alteration. Any work on an OSSF must be handled by a licensed installer or directly by the homeowner. If someone is paid for any part of the process, that person must be licensed by the state.

In most areas of the state, local authorities have taken on the responsibility for ensuring that OSSFs in their areas comply with all state requirements. Many local governments are authorized agents (AAs) of the TCEQ for administering the OSSF Program. Many times, an AA has a designated representative (DR) to assist it with its responsibilities, which include reviewing plans for constructing, altering, extending, or repairing each OSSF; issuing permits; and inspecting system installation.

Authorized agents and designated representatives also respond to complaints to ensure that an OSSF meets minimum standards. If problems are found, the system owner normally has 30 days in which to make substantial progress on remedying the situation. After that, the AA can file a criminal complaint with the local Justice of the Peace.

There are eight AAs in the seven counties located within the Lake O' the Pines watershed. In addition, the Northeast Texas Municipal Water District is the DR and permitting authority for OSSFs in Marion, Morris, and Cass Counties. NETMWD permits all OSSF in these counties except those on tracts of land 10 acres or more, and those inside certain city limits. The NETMWD also handles all complaints about OSSF in these three counties, and has six employees on staff for this purpose.

Designated representatives from within the TCEQ Region 5 area meet quarterly. This forum provides input for new rules and regulations and clarifications by the TCEQ staff attending the meetings. This group began meeting in 2003, and is a valuable tool for those working in the OSSF program.

Management Measure OSSF 1 - OSSF Program Administration

The authorized agents and designated representatives in the Lake O' the Pines watershed will continue to implement the OSSF program in accordance with state rules. Table 7 summarizes OSSF program activities in these counties for the years 2005, 2006, and 2007 as determined from monthly reports submitted to the TCEQ by the authorized agents in these counties. This information includes activities throughout each of these counties and therefore includes areas outside of the Lake O' the Pines watershed.

The existing OSSF program is funded through existing local, state, and federal sources. It is not anticipated that any new funding will be required to implement this management measure. The AAs, in collaboration with the TCEQ, provide technical assistance to individual homeowners on an "as needed" basis. The performance measure for OSSF1 is the administration of 607 permits and 126 complaint investigations annually.

Management Measure OSSF 2 - OSSF Financial Assistance

In September 2004, the NETMWD began a project that provided support for replacing failing OSSFs. The project used funds from penalties assessed for violations of Texas environmental laws and made available under the TCEQ's Supplemental Environmental Project (SEP) program. The SEP program was developed as an approach to resolving enforcement actions and improving environmental quality in Texas. The SEP policy provides an alternative to payment of the full amount of an administrative penalty. It allows respondents in an enforcement action to use the money for a project that prevents pollution, reduces the amount of pollution reaching the environment, enhances the quality of the environment, or contributes to public awareness of environmental matters.

Table 7. OSSF Program Activity for 2005, 2006, and 2007

Authorized Agent	Applications	Permits	Complaint Investigations	Court Cases Filed
Camp County	203	203	2	1
Cass County	141	141	22	0
Harrison County	516	505	123	721
Marion County	104	102	40	17
Morris County	36	38	13	1
Titus County	279	266	109	7
Titus Co. Fresh Water Supply District	108	106	18	1
Upshur County	455	460	50	14
Total	1842	1821	377	762
Annual Average	614	607	126	254

In the Cypress Creek Basin, SEP funds were used for the replacement of 40 failed OSSFs at a cost of approximately \$4,500 per system. These septic systems produced 9,297 gallons of sewage discharged per day, or more than 14,133 tons per year. Now these systems have the capacity to properly treat this sanitary wastewater.

The funding for the SEP project has been largely expended. Replacement of additional OSSF will require additional funding. The goal for the program is to replace up to 40 OSSF per year at an approximate annual cost of \$200,000 for the next three year planning period. Additional program plans will be evaluated at that time. The performance measure for OSSF2 is financial assistance for replacement of failing septic systems.

Management Measures for Marine Sanitation

The Marine Sanitation Device program on Lake O' the Pines was enacted in July 2001, when the NETMWD passed resolution #01-03. Title 30, Chapter 321 Subchapter A of the Texas Administrative Code and applicable rules of the TCEQ allow for local enforcement of Boat Sewage Disposal rules. The resolution prohibits the discharge of waste or sewage

from toilet facilities on boats and requires boats with toilet facilities to have an approved marine sanitation device. Additionally, boats with toilet facilities must be inspected by the NETMWD and display an inspection decal in accordance with District rules.

The biggest issue in the implementation of this resolution is the disposal of gray water. Recognizing this, the NETMWD issued hardship permits for owners that have no way to capture gray water but are trying to comply with the rules. The NETMWD continues to take water samples at various designated places on Lake O' the Pines, public swimming beaches, marinas, and open water sites for comparison and identification of water quality issues.

Management Measure MS 1- Marine Sanitation Device Permitting

There are 146 boat owners on Lake O' the Pines that potentially require permitting under the Marine Sanitation Device program. Full compliance permits have been issued to 36 of these boat owners, 50 hardship permits have been issued, and 12 black water issues have been corrected. Approximately 60 boats remain to be inspected. The goal for the program is to issue permits for the remaining boats in the next two years and continue full implementation of the program. This program is funded by the NETMWD. It is not anticipated that any new funding will be required to implement this management measure. The NETMWD provides technical assistance to individual boat owners on an "as needed" basis. The performance measure for MS1 is the issuance of permits for new vessels and administration of existing permits.

Management Measures for Land Application Sites

Sewage sludge (the residue generated during treatment of domestic sewage), domestic septage (residues from OSSFs), and other wastes may be applied to the land for beneficial purposes if authorized by the TCEQ. These materials can improve the chemical and physical properties of soils because they contain nutrients and trace elements important for plant growth. Title 30, Chapter 312 of the Texas Administrative Code establishes standards for the final use or disposal of these materials. The rules establish management requirements for limiting chemical concentrations, pathogen densities, and vector attraction. The rules establish requirements for the frequency of monitoring, record keeping, and reporting. Depending on the nature of the material, authorization from the TCEQ to apply sewage sludge or domestic septage to land is in the form of a permit, registration, or notification.

Management Measure LA 1 - Land Application Permitting

There are three permitted land application sites in the Lake O' the Pines watershed as identified in Table 8. The TCEQ administers the permit and performs regular inspections to ensure compliance with the provisions of the permits. The TCEQ program for permitting land application sites is funded through existing state appropriations and federal grants. The TCEQ does not anticipate that any new funding will be required to implement this management measure. The TCEQ provides technical assistance to individual operators of sludge application sites as needed. The performance measure for LA1 is administration of land application permits.

Table 8. Permitted Land Application Sites in the Big Cypress Basin

Permittee	Permit Number	Permit Type	County
City of Mount Pleasant	04583	Municipal	Titus
International Processing Corp	04103	Industrial	Titus
John Van De Laar	03019	Industrial	Titus

Watershed Educational Activities

The intent of educational outreach activities for the Lake O' the Pines watershed is the promotion of efficient and wise use of phosphorus within the watershed. Education is a primary tool in achieving water quality goals in this watershed. The target audience of the educational activities includes (but is not limited to) commercial providers of phosphorus, homeowners who fertilize their lawns and gardens, agricultural producers, forestry operators, and homeowners with OSSFs. Opportunities for improvement in the utilization of phosphorus exist in each of these groups with education having a significant effect on the degree of implementation of best management practices. The intent is to utilize existing programs and governmental entities to the maximum extent practical. Implementation will include at least the following:

- 1) disseminating educational materials through mass communications like Internet sites, fliers, newsletters, magazines, memos, reports.
- 2) conducting conferences focused on education to achieve changes in habits.
- 3) communicating person-to-person (e.g., site visits and telephone calls.)

Specific programs for target audiences and entities that will implement these programs in the Lake O' the Pines watershed are described in the following Management Measures.

Management Measure ED 1 - Education for Commercial Providers

As part of the educational outreach, an annual effort shall be made to identify all of the providers that sell phosphorus within the watershed. At least annually, an outreach effort will be made to raise the awareness within the commercial providers as to the effect of phosphorus applications within the watershed and the need to efficiently and appropriately use phosphorus. The customer base of the commercial providers could include golf courses, hayfields, lawns, and growing crops. The annual workshops will be hosted by the NETMWD at a cost of approximately \$2,500 to be paid by the NETMWD.

Management Measure ED 2 - Education for Homeowners Who Fertilize Lawns and Gardens

Residential property owners will be provided information on methods that avoid excessive fertilization of yards and gardens. Existing programs through the Texas AgriLife Extension Service and others will be utilized to increase awareness of the phosphorus concern within the watershed and appropriate control measures.

The Master Gardener Program is a volunteer program designed to increase the availability of horticultural information to residents and improve the quality of life through horticultural projects. Offered by AgriLife Extension, program objectives are implemented through the training and working with local volunteers, known as Master Gardeners, who aid Extension by conducting school garden projects, answering telephone requests for horticultural information, establishing and maintaining demonstration gardens, working with special audiences in the community, designing and implementing community improvement projects, and coordinating Master Gardener projects.

The administration of the Master Gardener program requires AgriLife Extension to recruit participants, conduct training for volunteers, certify and re-certify Master Gardeners, develop volunteer activities and projects, track volunteer service, and recognize Master Gardeners for volunteer service and leadership.

Trainees must receive a minimum of 50 hours of instruction, pass an examination, and volunteer a minimum of 50 hours of service to earn the title of "Texas Master Gardener." In order to retain the Texas Master Gardener title, individuals are required each year to participate in a minimum of 6 hours of recertification training and provide an additional 12 hours of volunteer service through the local Extension office. Documentation requirements and validation of training and volunteer service hours for recertification are under the purview of the County Extension Agent or an individual designated by the agent.

The Titus and Camp County Extension offices collaborate on the Master Gardener program in the Lake O' the Pines watershed. They conduct one training program for approximately 20 new program participants and an equal number of returning participants each year. AgriLife Extension will track Master Gardener participation in training programs and advise Master Gardeners to contribute volunteer hours that support this management measure. The Master Gardener program is funded by AgriLife Extension.

Management Measure ED 3 - Education for Agricultural Producers

Agricultural producers are an important part of the economy in this watershed. Use of phosphorus is an essential part of the production. Educational outreach by local SWCDs, water districts, industry associations, and others will be part of this implementation. Educational topics include phosphorus loadings and ways to reduce loading. For example, proper tillage practices that reduce erosion as well as phosphorus. These programs are funded by AgriLife Extension.

AgriLife Extension will continue to host producer education activities, including field days and demonstrations, that promote understanding and adoption of best management practices among agricultural producers, ensure agricultural producers can maintain certifications (of WQMPs) by providing compliance assistance, and support the profitability of agricultural enterprises by promoting awareness of federal and state cost-share programs to assist with adoption of effective technologies and best management practices. The TSSWCB and NRCS will support Extension outreach and education initiatives in the Lake O' the Pines watershed.

Management Measure ED 3.1 – CEU Seminars

The Camp and Titus County Extension offices jointly sponsor an annual Northeast Texas Pesticide Seminar and Licensing School. Attendance at the seminar allows attendees to earn Continuing Education Credits towards the maintenance of their pesticide applicators license issued by the Texas Department of Agriculture. These are one-day events with up to 200 persons in attendance. A range of topics is presented at these seminars, including water quality, nutrient management, and soil tests. AgriLife Extension will incorporate appropriate themes and topics from this I-Plan into these seminars.

Management Measure ED 3.2 - Educational Programs

AgriLife Extension co-sponsors ongoing educational programs with the Texas Farm Bureau and others. These are evening or luncheon events with up to 70 people in attendance. One of the objectives of these meetings is to update local agricultural producers on relevant research. A range of topics are presented at these programs including water quality and managing forages to avoid the buildup of phosphorus in soil, streamside management zones, and organic fertilizers. Approximately six of these educational programs are presented each year in the Lake O' the Pines watershed. AgriLife Extension will incorporate appropriate themes and topics from this I-Plan into these educational programs.

Management Measure ED 4 - Education for Homeowners with OSSFs

Rural residences have the potential to generate phosphorus loadings to the Lake O' the Pines due to malfunctioning OSSFs. It is therefore important that rural residences have fully functional OSSFs. An educational outreach program for homeowners with OSSFs will be initiated by NETMWD in cooperation with the OSSF educational programs of AgriLife Extension.

As part of the educational outreach, forums will be held to educate the public on the need and value of a properly working OSSF. These forums will be sponsored by the NETMWD. A biannual newsletter will also be developed for reaching those rural residents that fail to come to the OSSF educational meetings. The newsletter will encompass the educational information given at the area meetings as well as information on new technology in the on-site industry.

Within the watershed, designated representatives will work to educate the property owners on the proper ways to manage the phosphorus generated from these OSSF activities and other waste generated from residential activities. The NETMWD will conduct up to three workshops per year. The costs of the workshops will be approximately \$1,000 per year and will be paid for by the NETMWD.

Management Measure ED 5 - Education for Forestry Operations

Educational outreach programs are an integral part of the state forestry program. New and innovative technology transfer vehicles such as commercials, highway billboards, and hands-on interactive displays educate and encourage project participation. Local media are used to promote project tasks. Forestry seminars, held throughout East Texas and major metropolitan areas, provide information to forest landowners on sustainable forestry, including ways to protect soil and water resources. TFS produces a quarterly silvicultural newsletter to promote various BMPs to landowners and natural resource professionals.

This increases communication, maintaining frequent, periodic technology transfer between natural resource professionals and forest landowners. Another innovative opportunity to promote BMPs to the public is through the annual Teachers Conservation Institute, a week-long environmental education session for teachers. This program can have a tremendous impact when teachers take what they learn back to their classrooms. The TSSWCB supports TFS education programs through Clean Water Act Section 319(h) grants. The costs of this educational program were discussed previously under the Forestry Operations management measures. The project includes areas outside of the Lake O' The Pines watershed.

Watershed Management Support Activities

Activities will be undertaken to support overall watershed management programs in the Lake O' the Pines watershed. These actions may not be of immediate use in achieving the TMDL implementation goals, but they may necessary for an adaptive response to future findings or conditions and for continuing watershed management.

Management Measure WMS 1 – Update SWAT Model

The monitoring results from the Big Cypress Creek routine monitoring stations and the results of the ongoing “edge of field” studies supported by the TSSWCB may be used to refine and validate the existing SWAT models developed during the TMDL studies. These models can be used to predict the water quality consequences of changes in land use, or to evaluate shorter term responses during climatic extremes. The SWAT model can be used to evaluate other conditions on the watershed not related to agricultural or waste treatment BMP strategies that may influence nutrient loads, such as abnormal hydroclimatology or land use changes. It will also allow extrapolation to conditions different from those encountered during the TMDL studies, and provide an economical means of evaluating alternative load reduction strategies or assessing nutrient loading levels under varying future watershed conditions. This may play a role in interpreting seasonal changes in monitoring results, and in distinguishing trends or fluctuations affected by cycles of wet and dry climate from actual reductions in nutrient loading from point and non point sources. Specific plans for this modeling may be considered later depending upon the results of the initial implementation, tracking and monitoring programs described in this plan.

Management Measure WMS 2 – Update Water Quality Model

The QUALTX model developed during the TMDL studies to relate nutrient loads in inflows to metabolic activity in Lake O' the Pines can be used, like the SWAT model, to evaluate and interpret lake water chemistry data collected under varying hydroclimathological conditions. However, many aspects of the QUALTX formulation potentially limit its utility in application to Lake O' the Pines. During the original TMDL work, the desirability of using a different model, WASP, for Lake O' the Pines was appraised, but it was not sufficiently developed at that time. In the past three years, the EPA has revised WASP several times, and appears to have fixed the various problems. During this same period, the Corps of Engineers has substantially updated and revised its BATHTUB model. It may be desirable now to evaluate either of these models as a replacement for the QUALTX model. The principal benefit would be that each employs more sophisti-

cated and complex kinetics depicting plankton nutrient assimilation and metabolism. Confidence in the modeled relation between the landscape loading processes and the water quality in Lake O' the Pines would be greatly increased by such an improved model. Specific plans for this modeling may be considered later depending upon the results of the initial implementation, tracking and monitoring programs described in this plan.

Management Measure WMS 3 – Sediment Study

The USGS recently completed a study evaluating total phosphorus concentrations in sediments in the Caddo Lake watershed. The study sampled 51 sites, 9 of which were in the Lake O' the Pines watershed. The results of the study found total phosphorus concentrations to range from 12.6 to 6,850 mg/kg with an average concentration of 326 mg/kg and a median concentration of 154 mg/kg. Total phosphorus in the sediments of Lake O' the Pines may influence the ability to achieve the dissolved oxygen criteria in the reservoir. The role of total phosphorus in sediments may need to be further evaluated for Lake O' the Pines depending upon the results of the initial implementation, tracking and monitoring programs described in this plan.

Management Measure WMS 4 – Re-evaluate Water Quality Standards

Lake O' the Pines, in common with other shallow reservoirs, is characterized by a zone of transition from the lotic conditions of its largest tributary, Big Cypress Creek, to the open water lentic environment of the lower lake (Lind, 2002). This reach is commonly the site of maximum sediment accumulation, with high rates of microbial metabolism as newly delivered nutrients and organic materials are rapidly utilized for primary and secondary production. The zone typically exhibits extensive rooted plant biomass where sediments are suitable and shallow water prevalent, as is the case in most of east Texas. Because the transition zone is an area of high biological activity, it is not uncommon that summer microbial production and respiration results in substantial change in dissolved oxygen concentration over a diel (24 hour) cycle. Dissolved oxygen conditions may also be affected by the presence of dense stands of rooted vegetation. In addition to the production and consumption of dissolved oxygen by the rooted plants themselves, the metabolism of the attached biofilm community (e.g., algae, other protozoa, bacteria, rotifers, ostracods, annelids), together with the impairment to mixing and physical reaeration in dense plant beds, may impact the dissolved oxygen budget locally and result in violations of segment water quality standards.

Although it is possible that the Lake O' the Pines transition zone will be reduced in area (and with respect to the more extreme conditions that occur there) because of nutrient and sediment load reduction, it is unlikely to disappear entirely. Occasional episodes when dissolved oxygen concentrations do not meet the average and minimum standard for the protection of high quality aquatic life use will likely continue to occur during periods of high water temperature and low inflow, particularly where vegetation is dense. TCEQ will consider the creation of a segment between the lower end of Segment 0404 (US 259 crossing of Big Cypress Creek) and the SH 155 crossing of Lake O' the Pines with a dissolved oxygen standard consistent with that in Big Cypress Creek, or a seasonally adjusted standard that recognizes the occurrence of a critical summer period.

Implementation Tracking

This I-Plan includes provisions to track the progress of the plan using both implementation and water quality milestones and indicators. These terms are further defined as:

- **Implementation Milestones** – Measures of administrative actions undertaken to effect an improvement in water quality.
- **Water Quality Indicators** – Measure of water quality conditions for comparison to pre-existing conditions, constituent loadings, water quality standards, or other appropriate measure.

Implementation tracking provides information that can be used to determine if progress is being made toward meeting goals of the TMDL. Tracking also allows stakeholders to evaluate actions taken, identify those which may not be working, and make any changes that may be necessary to get the plan back on target.

Implementation Milestones

The I-Plan specifies tracking implementation activities in eight general categories: point source discharge permits, AFOs, forestry operations, OSSFs, marine sanitation, land application, and activities that support education and management in the watershed. The basis for tracking implementation activities in the Lake O' the Pines watershed are presented in Appendix A.

Point Source Discharge Permits. The TCEQ will be responsible for tracking the wastewater permitting tasks described in the Implementation Strategy section of the I-Plan. On an annual basis, the TCEQ will compile information on the status of the watershed association, permitting actions on individual and group permits, and compliance of permitted entities with permit requirements.

Animal Feeding Operations. The TSSWCB will be responsible for tracking the tasks described in the Implementation Strategy section of the I-Plan relating to the TSSWCB program for AFO. On an annual basis, the TSSWCB will compile information on the status of WQMP certifications, WQMP status reviews, cost-share funding allocated by TSSWCB, EQIP program funding, and the results of the BMP effectiveness study. The TCEQ will be responsible for tracking the tasks described in the Implementation Strategy section of the I-Plan relating to the TCEQ program for AFOs. On an annual basis, the TCEQ will compile information on permitting actions and compliance of permitted entities with permit and rule requirements.

Forestry Operations. The TSSWCB, in collaboration with the Texas Forest Service, will be responsible for tracking the tasks described in the Implementation Strategy section of the I-Plan relating to Forestry Operations. On an annual basis, the TFS will compile information on the final report on BMP Evaluations and the status of training workshops.

On-Site Sewage Facilities. The NETMWD will be responsible for tracking the tasks described in the Implementation Strategy section of the I-Plan relating to on-site sewage facilities. On an annual basis, the NETMWD will compile information on the status of

the OSSF program including permits issued and complaints investigated and the number of failing systems replaced under the financial assistance program.

Marine Sanitation. The NETMWD will be responsible for tracking the tasks described in the Implementation Strategy section of the I-Plan relating to marine sanitation. On an annual basis, the NETMWD will compile information on the status of the marine sanitation device permitting program including permits issued and vessels remaining to be permitted.

Land Application. The TCEQ will be responsible for tracking the land application permitting tasks described in the Implementation Strategy section of the I-Plan. On an annual basis, the TCEQ will compile information on permitting actions and compliance of permitted entities with permit requirements.

Watershed Educational Activities. The TSSWCB, in collaboration with Texas AgriLife Extension Service, will be responsible for tracking the tasks described in the Implementation Strategy section of the I-Plan relating to watershed educational activities. On an annual basis, Extension will compile information on the status of educational outreach targeting commercial providers, residential applicators, agricultural producers, and OSSF owners.

Watershed Management Support Activities. The NETMWD will be responsible for tracking the tasks described in the Implementation Strategy section of the I-Plan relating to activities that support watershed management. On an annual basis, the NETMWD will compile information on the status of the re-evaluation of the water quality standards for Lake O' the Pines and other relevant scientific investigations.

Water Quality Indicators

The TCEQ and stakeholders will evaluate three parameters to determine progress toward attaining the standard for high aquatic life use in Lake O' the Pines. Evaluation monitoring will track loadings of phosphorus, dissolved oxygen, and nutrients.

Phosphorus Loadings

Water quality monitoring will be conducted to determine total phosphorus loadings to Lake O' the Pines. The TMDL studies determined that about 80% of the water and 90% of the phosphorus was entering Lake O' the Pines through Big Cypress Creek; monitoring that tributary alone shall be sufficient to track the progress of TMDL implementation.

Monitoring total phosphorus loading will require a relatively intensive program of water sampling and analysis to obtain sufficient data to estimate annual loads. To assure that information is available to detect and address potential change in nitrogen loading and the role of that element during changing conditions in Lake O' the Pines, to provide the information necessary for future updates to the SWAT models of the Lake O' the Pines watershed, and for the context in which to analyze phosphorus monitoring data, water samples will also be analyzed for the nitrogen series, total organic carbon, total dissolved solids, and total suspended solids.

The primary location for monitoring nutrient concentrations will be the existing TCEQ monitoring station (13631) at the US 259 bridge that crosses the transition zone between Big Cypress Creek and Lake O' the Pines, and marks the division between Segments 0403 (Lake O' the Pines) and 0404 (Big Cypress Creek). Station 13631 is being instrumented by NETMWD to provide continuous monitoring of dissolved oxygen, temperature, specific conductance, pH, and chlorophyll a. These monitoring locations are illustrated in Figure 2.

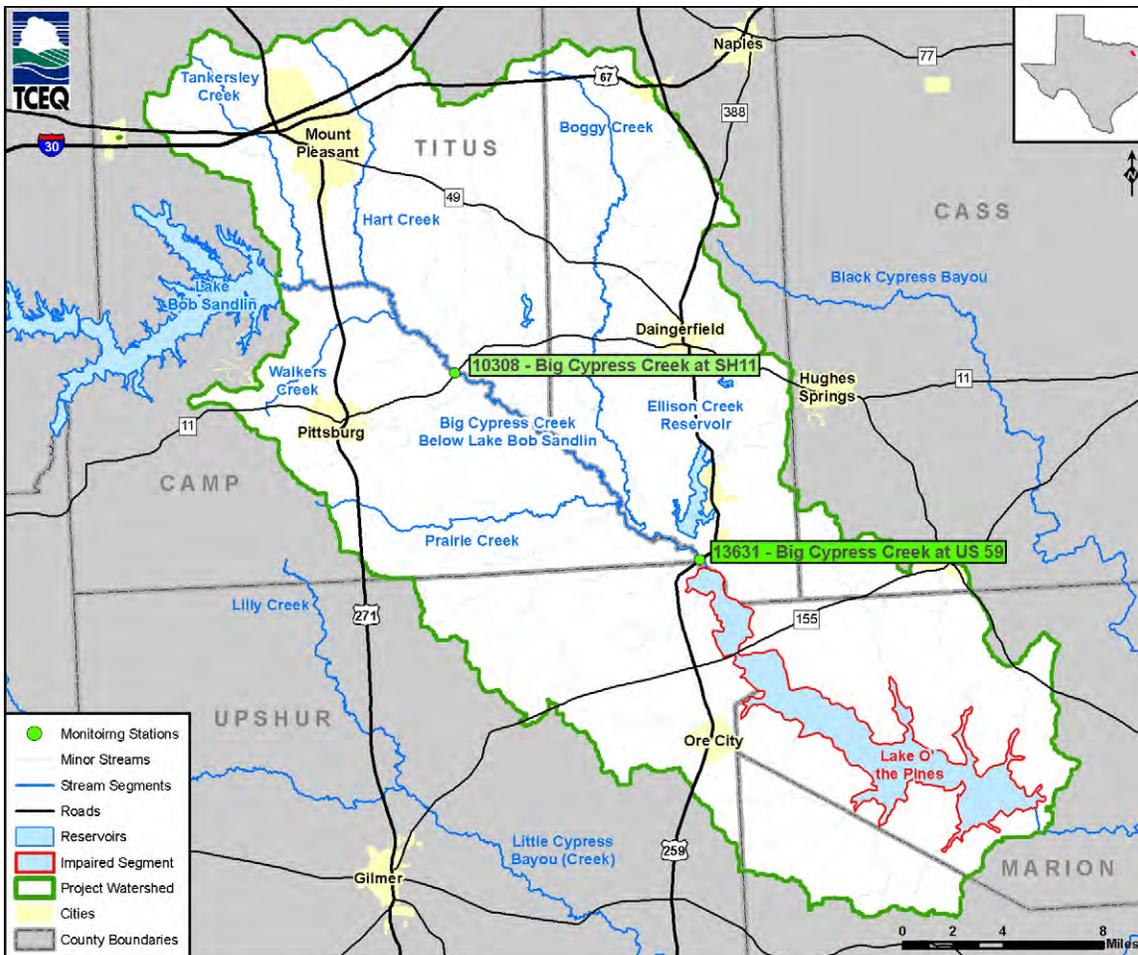


Figure 2. Monitoring Station Location Map

There is no stream gage at station 13631 because during wet periods Lake O' the Pines backwater extends far upstream of the US 259 bridge. TCEQ Station 10308, co-located at the SH 11 crossing of Big Cypress Creek near Pittsburg with USGS stream gage 07344500 is a recommended secondary monitoring station. This gage will be upgraded to a full range gage to provide the hydrologic data needed to calculate inflows to Lake O' the Pines. Station 10308 will provide direct information on the two largest point sources of nutrients in the watershed, several sub-watersheds that are known to contribute significant NPS nutrient loads to Big Cypress Creek, and allow continued evaluation of nutrient assimilation in the Big Cypress Creek floodplain.

A plan for sampling stations 13631 and 10308 to allow verification of the loadings of total phosphorus to Lake O' the Pines has been developed. During periods when flow in Big Cypress Creek at USGS Station 07344500 is less than 100 cubic feet per second (cfs) (the 60th percentile flow), water samples will be collected and analyzed monthly. During periods when flow in Big Cypress Creek is greater than 100 cfs, water samples will be collected and analyzed weekly. At flows greater than 1,000 cfs (the 93rd percentile flow) Big Cypress Creek will be sampled daily unless a discrete storm event is being monitored. Up to two discrete storm events per year to the extent possible. Three to five samples will be collected on the rising limb of the storm runoff, and a similar number will be collected on the falling limb, timed appropriately based on typical recession curves for Big Cypress Creek.

Dissolved Oxygen and Nutrient Monitoring in Lake O' the Pines

Water quality monitoring is being conducted to determine compliance with the state's water quality standards for dissolved oxygen in Lake O' the Pines. Water quality monitoring will also be conducted to monitor total phosphorus and related constituents in Lake O' the Pines.

The monitoring is accomplished at the two automated stations to be established by NETMWD and the U.S. Army Corps of Engineers and at the TCEQ routine station (17087) above the SH 155 causeway. The two automated stations are located at station 10296 in the main pool near the dam and station 10297 adjacent to the NETMWD intake. The platforms monitor dissolved oxygen, temperature, pH, conductivity, and chlorophyll *a*. Periodic grab samples are required to calibrate the chlorophyll *a* sensors. In order to increase the frequency of nutrient sampling in the lake so reasonable estimates of lake-wide nutrient concentration and content can be made, water samples will be collected concurrently with the chlorophyll *a* calibration samples, or at least monthly, at the two automated stations in the main lake basin (10296 and 10297), and the TCEQ routine station (17087).

Monthly water samples will be analyzed for the nutrient parameter set identified above. Since algal blooms in Lake O' the Pines have been observed to occur at total phosphorus levels at and above 0.7 mg/l, the lower reporting limits employed for the Segment 0404 samples will be used in the reservoir to reduce the uncertainty associated with large numbers of censored values when trying to calculate lake-wide average concentrations and loads. The ability of the automated stations to monitor diel dissolved oxygen levels provides a unique opportunity to assess conditions throughout the lake, define the dissolved oxygen climate of Lake O' the Pines, and monitor its seasonal and interannual variation. The frequency and nature of low dissolved oxygen concentration episodes will be a direct measure of standards attainment and progress in implementing the TMDL.

Sampling and analytic methods for phosphorus loadings and water quality in the reservoir will follow state protocols. The cost of upgrading the flow gage at station 10308 is estimated to be \$50,000 and an estimated annual cost of \$15,000 to operate and maintain the gage. The costs of monitoring phosphorus loadings to the reservoir and water quality in the reservoir as described are estimated to be \$90,000 per year. Funding for these activi-

ties will be sought from existing monitoring program resources as well as other state and federal sources.

Review Strategy

This I-Plan is a flexible tool that permits stakeholders to adapt to changing circumstances and to apply the lessons learned from experience. The TCEQ and stakeholders in TMDL implementation projects will periodically assess the results of the planned activities and other sources of information to evaluate the adequacy of the I-Plan. Project stakeholders evaluate several factors, such as the pace of implementation, the effectiveness of best management practices, load reductions, and progress toward meeting water quality standards. The I-Plan presents a general process and timetable that specifies how and when the I-Plan will be evaluated and may be revised. Stakeholders will document the results of these evaluations and its rationale for maintaining or revising elements of the I-Plan, and will present them as part of the state's reporting processes and through local informational outlets.

The results of implementation and water quality tracking activities in the Lake O' the Pines watershed will be reviewed annually by the Lake O' the Pines watershed stakeholders to support decision-making with respect to their evaluation of the adequacy of the I-Plan and its component elements. As part of this evaluation, stakeholders will review implementation activities and the monitoring results to determine if progress is being made toward achieving project goals. Actual results will be compared to goals established in the I-Plan. Compliance with the wasteload allocation established in the TMDL for point source dischargers will be determined based on a review of annual monitoring reports submitted to the TCEQ.

Monitoring data will be analyzed and summarized to determine achievement of loading targets and water quality standards. The seasonal course of change in nutrient concentrations and loads will be calculated for Big Cypress Creek at SH 11 and at US 259. Hydraulic loading of Lake O' the Pines will be calculated with the streamflow data from USGS gage 07344500 (SH 11), the drainage area relationship with Station 13631 (US 259), and streamflow data available from adjacent, uncontrolled drainages (Black Cypress Bayou and Little Cypress Creek).

Compliance with the load allocation established in the TMDL for nonpoint sources in the watershed will be determined by calculating the annual loading of total phosphorus to Lake O' the Pines as described above and subtracting the corresponding loadings from point sources and the estimated background loading.

The nutrient concentrations and dissolved oxygen regimes present at the automated stations in the reservoir, together with monthly data from Station 17087, will be summarized to characterize seasonal changes, standards compliance, and progress with respect to the TMDL goals.

Data analysis during the initial years of monitoring will also focus on evaluation of sampling methods and frequencies in order to maximize the efficiency of monitoring nutrient

loading and the response of dissolved oxygen concentrations in Lake O' the Pines. Statistical characteristics of this data set will be evaluated to determine the sampling intensity necessary to detect given levels of change in the target parameters, and to better assess the likely time required to achieve the goals of the TMDL.

If stakeholders determined that implementation milestones and/or targets for load reductions or ambient water quality conditions are not being met, further analyses will be required. The reasons for not meeting the project goals must be ascertained. This analysis will consist of answering such questions as:

- Is the evaluation timeframe sufficient to allow progress to be detected? Sometimes it takes much longer to see results in the water body than anticipated.
- Has the evaluation period been representative of longer-term conditions in terms of weather, watershed activities, or other factors?
- Are control actions being enforced properly? Are additional efforts required to support compliance programs?
- Are management measures sufficient to meet load allocations stipulated in the TMDL?
- Are management measures being maintained properly? Are additional efforts required to support maintenance programs?
- Was the TMDL accurate? Does it accurately portray how water quality conditions will respond to changes in watershed loadings?

Stakeholders may determine that there are sufficient reasons why project goals are not met during the evaluation period and conclude that implementation of the plan should continue. Alternatively, stakeholders may determine the plan or elements of the plan to be insufficient and make modifications to the plan. The results of these assessments and the rationale for maintaining or modifying the plan will be documented. Substantive modifications of the plan will require state agency approvals.

Communication Strategy

Communication is necessary to ensure that stakeholders understand the I-Plan and its progress in restoring water quality conditions. The TCEQ and the TSSWCB will disseminate the information derived from tracking I-Plan activities to interested parties, including watershed stakeholders, state leadership, government agencies, nongovernmental organizations, and individuals.

The TCEQ publishes a report biennially summarizing the status of TMDL projects in the state. This report provides a forum for publicizing the status of individual TMDLs as well as the state's TMDL program. Information derived from tracking and review activities of the I-Plan for Lake O' the Pines will be submitted to the TCEQ for publication in the TMDL Program Status Report.

The TCEQ and the TSSWCB cooperate in the annual publication summarizing the accomplishments of the state's *Nonpoint Source Management Program*. Information derived from tracking and review activities of the I-Plan for Lake O' the Pines will be

submitted for publication in the state's *Annual Report on Managing Nonpoint Source Pollution in Texas*. Both documents are available on the Web at <www.tceq.state.tx.us/nav/eq/nonpointsrcpgm.html>.

Presentations on the results of the tracking and review activities of the I-Plan for Lake O' the Pines will be made to regular meetings of basin stakeholders at the Cypress Creek Basin Clean Rivers Program/Lake O' the Pines TMDL Combined Steering Committee. In addition to meeting presentations, tracking and monitoring results will be posted to a dedicated internet Web page and included in water quality publications for the basin.

References

- Cooke, D.G., et al. 1993. Restoration and Management of Lakes and Reservoirs. Lewis Publishers, Boca Raton.
- Lind, O.T. 2002. Reservoir Zones: Microbial Production and Trophic State. Land and Reservoir Management 18(2): 129-137.
- Reckhow, K. 2007. Adaptive Implementation–Executive Summary. Watershed Management to Meet Water Quality Standards and TMDL, 4th Conference Proceedings. American Society of Agricultural and Biological Engineers, pp 15-17.
- Shabman, L., et al. 2007. Adaptive Implementation of Water Quality Improvement Plans: Opportunities and Challenges. Nicholas School of Environment and Earth Sciences, Nicholas Institute, Duke University
- TCEQ 2006. One Total Maximum Daily Load for Dissolved Oxygen in Lake O' the Pines.
- USEPA 2003. Watershed-based National Pollutant Discharge Elimination System (NPDES) Permitting Implementation Guidance, EPA 833-B-03-004.

Appendix A. Summary of Actions to Implement the Lake O' the Pines TMDL

Action	Responsible Party	Performance Measure	Goal	Interim Milestones by Year				
				1	2	3	4	5
PS1 – Establish entity responsible for group permit	Co-permittees in group permit	Establish entity	1	1	-	-	-	-
PS2.1 – Permitting, Industrial Permit Amendment	Pilgrim's Pride Corp	Submit application	1	1	-	-	-	-
	TCEQ Permits	Issue permit amendment	1	-	1	-	-	-
PS2.2 – Permitting, Municipal Permit Amendment	TCEQ Permits	Issue permit amendment	Up to 7	-	Up to 7	-	-	-
PS2.3 – Permitting, Group Permit	Group permit entity	Submit application	1	-	1	-	-	-
	TCEQ Permits	Issue permit	1	-	-	1	-	-
PS3 – Permit Implementation	Permittees	Permit compliance	8	-	-	-	-	8
AG1.1 – Animal Feeding Operations	TSSWCB	Certify WQMP-Poultry	105	105	105	105	105	105
		Certify WQMP-Dairy	6	5	5	6	6	6
		WQMP status review	25% /Yr	36	36	36	36	36
AG1.2 – Animal Feeding Operations	TCEQ	Administer permits and authorizations	4	4	4	4	4	4

Action	Responsible Party	Performance Measure	Goal	Interim Milestones by Year				
				1	2	3	4	5
		Inspection	4 / Yr	4	4	4	4	4
AG2 – Financial Assistance	TSSWCB	WQMP Program funding (state appropriations)	\$81,000/Yr ⁽¹⁾	\$81,000	\$81,000	\$81,000	\$81,000	\$81,000
	NRCS	EQIP Program funding (federal appropriations)	\$144,000/Co-Yr ⁽²⁾	\$144,000	\$144,000	\$144,000	\$144,000	\$144,000
AFO3 – BMP Evaluations	NETMWD, TSSWCB	Final project report	1	1	-	-	-	-
FO1 – BMP Evaluations	TFS	BMP Implementation Evaluation	150 sites/ 3 Yrs ⁽³⁾	150 sites	-	-	150 sites	-
FO2 – Technical Assistance	TFS	Training workshops	3 / Yr	3	3	3	3	3
OSSF1 – OSSF Program Administration	Authorized Agents, Designated Representatives	Administer Permits	607 / Yr	607	607	607	607	607
		Complaint investigations	126 / Yr	126	126	126	126	126
OSSF2 – Financial Assistance	NETMWD	Systems replaced	40 / Yr	40	40	40	-	-
MS1 – Marine Sanitation	NETMWD	Permitted new vessels	30 / Yr	30	30	-	-	-

Action	Responsible Party	Performance Measure	Goal	Interim Milestones by Year				
				1	2	3	4	5
WMS4 – Re-evaluate Water Quality Standards	TCEQ	Participate in SWQS revision	On-going	-	-	-	-	-

- Notes:** (1) Funding level depends on appropriations from the Texas Legislature
(2) Funding level depends on reauthorization of the Farm Bill and future Congressional appropriations.
(3) Site total includes sites that are not in the Lake O' the Pines watershed.