

TABLE OF CONTENTS

	<u>Page</u>
List of Tables	iv
List of Figures	v
List of Abbreviations.....	vi
EXECUTIVE SUMMARY	ES-1
Program Objectives	ES-1
Program Successes and Benefits	ES-2
Significant Findings	ES-3
Wright Patman Lake	ES-4
White Oak Creek.....	ES-7
Sulphur River and South Sulphur River Between Wright Patman Lake and Cooper Lake	ES-7
Big Creek Lake.....	ES-8
Basin Planning	ES-8
Recommendations.....	ES-9
CHAPTER 1. INTRODUCTION	I-1
Texas Clean Rivers Program.....	I-1
Purpose of Summary Report	I-4
Description of Basin	I-4
Subwatershed Summaries	I-8
North Sulphur River Subwatershed.....	I-9
South Sulphur River Subwatershed.....	I-9
Segment 306 - Upper South Sulphur River.....	I-10
Segment 307 - Cooper Lake	I-11
Segment 303 - South Sulphur River.....	I-11
Sulphur River Subwatershed.....	I-11
White Oak Creek Subwatershed	I-13
Wright Patman Lake Subwatershed.....	I-14
Segment 302 - Wright Patman Lake	I-14
Segment 301 - Sulphur River below Wright Patman Lake	I-15
Days Creek Subwatershed.....	I-15
Water Quality in the Basin	I-16
Coordination with Others	I-17
Public Involvement.....	I-18
CHAPTER II. PUBLIC INVOLVEMENT	II-1
Public Outreach.....	II-1
Steering Committee.....	II-2
CHAPTER III. BASIN WATER QUALITY	III-1
Monitoring Program.....	III-1
Historical Monitoring Program	III-1
Current Monitoring Program.....	III-1
Fixed Monitoring	III-4
Systematic Monitoring.....	III-4
Targeted Monitoring	III-9
Summary of Water Quality	III-9
Regional Variations in Water Quality	III-10
Areas of Concern	III-10
Wright Patman Lake	III-13

TABLE OF CONTENTS
(Continued)

	<u>Page</u>
Sulphur River and South Sulphur River Between Wright Patman Lake and Cooper Lake	III-13
Big Creek Lake	III-14
White Oak Creek	III-14
Areas of Improvement	III-15
 CHAPTER IV. TECHNICAL SUMMARY	 IV-1
Data Evaluation Processes	IV-1
Subwatershed Summaries	IV-2
North Sulphur River Subwatershed	IV-2
South Sulphur River Subwatershed	IV-4
Segment 306 - Upper South Sulphur River.....	IV-4
Segment 307 - Cooper Lake	IV-11
Segment 303 - South Sulphur River	IV-13
Sulphur River Subwatershed.....	IV-15
White Oak Creek Subwatershed	IV-19
Wright Patman Lake Subwatershed.....	IV-22
Segment 302 - Wright Patman Lake	IV-22
Segment 301 - Sulphur River below Wright Patman Lake	IV-28
Days Creek Subwatershed.....	IV-28
 CHAPTER V. CONCLUSIONS AND RECOMMENDATIONS	 V-1
Preliminary Basin Action Plan	V-1
Conclusions.....	V-1
Basin Recommendations	V-5
Monitoring Recommendations	V-5
Programmatic Recommendations	V-7
Regulatory and Legislative Recommendations	V-7

TABLE OF CONTENTS
(Continued)

	<u>Page</u>
APPENDICES	
APPENDIX A	
APPENDIX B	
APPENDIX C	
APPENDIX D	
APPENDIX E	
SULPHUR RIVER BASIN AUTHORITY BOARD OF DIRECTORS	A-1
SULPHUR RIVER BASIN AUTHORITY, CLEAN RIVERS PROGRAM STEERING COMMITTEE.....	B-1
PARAMETERS MEASURED BY EACH AGENCY.....	C-1
POPULATION PREDICTIONS.....	D-1
EVENTS INVENTORY.....	E-1

LIST OF TABLES

<u>No.</u>	<u>Description</u>	<u>Page</u>
ES-1	Screening Program Results 1999 Basin Summary Report	ES-5
ES-2	Statistical Summary of Parameters Exceeding Screening Criteria	ES-6
III-1	Sulphur River Basin Monitoring Stations.....	III-2
III-2	FY 1999 Fixed Monitoring Program.....	III-5
III-3	FY 1999 Systematic Monitoring Program.....	III-8
III-4	Screening Program Results 1999 Basin Summary Report	III-11
III-5	Statistical Summary of Parameters Exceeding Screening Criteria	III-12
III-6	24-Hour Average Concentrations Recorded During Intensive Surveys.....	III-16
V-1	Preliminary Basin Action Plan	V-2
V-2	Recommendations.....	V-6

LIST OF FIGURES

<u>No.</u>	<u>Description</u>	<u>Page</u>
I-1	Sulphur River Basin	I
		-5
I-2	TNRCC Designated Segments	I-7
III-1	1999 Monitoring Program and Basin Characteristics	III-3
IV-1	North Sulphur River Subwatershed	IV-3
IV-2	Fecal Coliform in the North Sulphur River, Station 10231	IV-5
IV-3	South Sulphur River Subwatershed	IV-6
IV-4	Dissolved Oxygen, Nutrients, Chlorophyll- <i>a</i> , and pH and Fecal Coliform in the South Sulphur River, Station 10234	IV-7
IV-5	Dissolved Oxygen, Dissolved Phosphorus and pH in the South Sulphur River, Station 10238	IV-9
IV-6	Dissolved Oxygen and Dissolved Phosphorus in the South Sulphur River, Station 13632	IV-10
IV-7	Dissolved Oxygen and pH in Cooper Lake, Stations 13855/13856	IV-12
IV-8	Dissolved Oxygen, pH, and Dissolved Phosphorus in Cooper Lake, Stations 13857/13858	IV-14
IV-9	Sulphur River Subwatershed	IV-16
IV-10	Dissolved Oxygen, Nutrients, and Chlorophyll- <i>a</i> in the Sulphur River, Station 10215	IV-17
IV-11	White Oak Creek Subwatershed	IV-20
IV-12	Dissolved Oxygen, and Nutrients in White Oak Creek, Station 10198	IV-21
IV-13	Wright Patman Lake Subwatershed	IV-23
IV-14	Dissolved Oxygen, Dissolved Phosphorus, and pH in Wright Patman Lake, Stations 14097/14100	IV-24
IV-15	Dissolved Oxygen, Dissolved Phosphorus, and pH in Wright Patman Lake, Stations 14099/14102	IV-26
IV-16	Temperature and Dissolved Oxygen in Wright Patman Lake, Station 14104	IV-27
IV-17	Dissolved Oxygen, Nutrients, Chlorophyll- <i>a</i> , and pH in Sulphur River, Station 13783	IV-29
IV-18	Days Creek Subwatershed	IV-30
IV-19	Nutrients in Days Creek, Stations 15256/15342	IV-32
IV-20	Dissolved Oxygen, Nutrients, and Fecal Coliform in Days Creek, Station 10226	IV-33

LIST OF ABBREVIATIONS

Ag	silver
Al	aluminium
As	arsenic
Cd	cadmium
Chl-a	chlorophyll- <i>a</i>
Cl	chloride
CN	cyanide
Cr	chromium
CRP	Clean Rivers Program
Cu	copper
DO	dissolved oxygen
DP	dissolved phosphorus
EPA	U.S. Environmental Protection Agency
F	Fahrenheit
FC	fecal coliform
FM	Farm-to-Market
FY	Fiscal Year
MAL	Minimum Analytical Limits
mg/L	milligrams per liter
Mg	magnesium
Mn	manganese
msl	mean sea level
NH ₃ - N	ammonia - nitrogen
Ni	nickel
NO ₃ +NO ₂	nitrate + nitrite
NTMWD	North Texas Municipal Water District
Pb	lead
RBA	Rapid Bioassessment
RWA	Receiving Water Assessment
s	in sediment
Se	selenium
SH	State Highway
SO ₄	sulfate
SRBA	Sulphur River Basin Authority
SRMWD	Sulphur River Municipal Water District
SWQM	Surface Water Quality Monitoring
Temp	temperature
TDS	total dissolved solids
TMDL	Total Maximum Daily Load
TNRCC	Texas Natural Resource Conservation Commission
TP	total phosphorus
ug/L	micrograms per liter
USGS	U.S. Geological Survey
UTRWD	Upper Trinity Regional Water District
w	in water
WWTP	wastewater treatment plant
Zn	zinc

EXECUTIVE SUMMARY

The Clean Rivers Act, as enacted with Senate Bill 818 by the 72nd Texas Legislature in 1991, requires the Texas Natural Resource Conservation Commission (TNRCC) to insure the performance of regional assessments of water quality on a watershed basis through the Clean Rivers Program (CRP). The objectives of the CRP are to use the watershed management approach to identify and evaluate water quality issues, to establish priorities for corrective action, and to work to implement those actions.

The TNRCC and local partners, primarily river authorities, are conducting these regional assessments as a cooperative effort. The Sulphur River Basin Authority (SRBA) is the local partner within the Sulphur River Basin. The SRBA Board of Directors actively participates in the CRP. The directors are committed to protecting water quality, developing the water resources in the basin, and promoting the involvement of the public.

This is the fourth regional assessment of water quality prepared by the SRBA for the Sulphur River Basin. In this Executive Summary, the objectives, successes, benefits, significant findings, and recommendations for this most recent cycle of the CRP are presented.

PROGRAM OBJECTIVES

The long-term objectives of the CRP include assessing water quality in the Sulphur River Basin and assisting in identifying management programs to maintain and enhance the water quality. The objectives also include strengthening public input and access to the water quality assessment process since this will result in a more comprehensive knowledge of water quality issues by the public and the development of management programs that consider the needs and objectives of a broad base of stakeholders.

The Sulphur River Basin Steering Committee maintains active involvement in the CRP activities and assists in identifying appropriate activities for the CRP. The Steering Committee has encouraged cooperative monitoring to leverage funds; prioritized watersheds in the basin for monitoring and analyses; requested specific areas be investigated to assist permit holders; and encouraged public participation through the creation of a web page on the Internet.

PROGRAM SUCCESSES AND BENEFITS

Successes of the CRP in the Sulphur River Basin during this most recent program cycle have included the following:

- Obtaining data on the nature of the receiving streams for the City of Bogata Wastewater Treatment Plant (WWTP). These data will enable TNRCC to prepare a permit for this WWTP that is based on actual conditions in the streams rather than default assumptions. A permit for Bogata is being prepared by TNRCC with the updated information.
- Assisting the TNRCC with an intensive survey of Rock Creek and White Oak Creek, the receiving waters for the City of Sulphur Springs WWTP discharge, in October of 1989. The intensive survey demonstrated significant water quality improvement compared to water quality observed during a previous intensive survey.
- Conducting monitoring to assist in determining whether the Sulphur River and South Sulphur River should be on the list of threatened and impaired waters prepared by TNRCC pursuant to Section 303(d) of the Clean Water Act [303(d) list] because of instream concentrations of aluminum, cadmium, and/or dissolved oxygen.
- Funding the U.S. Geological Survey (USGS) to operate a fixed monitoring station on the Sulphur River. This is the only station routinely collecting data in a 50-mile reach of the river.
- Updating the assessment of the quality of surface waters in the Sulphur River Basin. This review of water quality data identified segments with insufficient data for some parameters. In particular, data for organic toxics are typically absent in the database. Metals data are present at only a limited number of stations. In the future, the SRBA hopes to use the coordinated monitoring program to provide additional data to the extent possible.
- Creating a web page on the Internet for the Sulphur River Basin. The public has direct access to information on CRP activities, reports, maps, and data through this web page (address: www.sulphurr.org). The public can also use the web page to send electronic mail to SRBA's CRP consultant. The web page has links to other CRP partners and other agencies with an interest in water quality in the Sulphur River Basin.
- Hosting a meeting on April 23, 1999, to provide better coordination of monitoring activities in the basin.

One of the major statewide successes of the CRP is the increased coordination of water quality monitoring that has occurred. This increased coordination has led to the development of standardized quality assurance protocols for stream sample collection so that comparable data are collected by multiple agencies.

SIGNIFICANT FINDINGS

Five years of water quality data have been examined to characterize water quality in the Sulphur River Basin. Based on this evaluation, recommendations for future actions have been developed. Following is a summary of the results of the data evaluation and the specific recommendations for individual key water bodies.

The data review was conducted as a multi-step process. The initial step was an analysis of the most recent five years of water quality data using a screening program developed by the TNRCC. The program compared the data to criteria that were derived from the stream standards, or based on typical screening levels for parameters without stream standards (nutrients and chlorophyll). A minimum of nine data points for conventional parameters and five data points for metals and organics at a station was required for the parameters to be screened at that station.

The screening program calculated the percentage of data points exceeding the screening criteria for each parameter at each station. If more than ten percent of the data exceeded the criteria, further data evaluations were conducted to verify that a water quality concern exists, to obtain an understanding of the magnitude of the problem, to identify trends in water quality, and, if possible, to identify a source of the pollutants of concern. In some cases all of these objectives can not be accomplished with the existing data, and further data collection is recommended.

The results of the screening program are presented on Tables ES-1 and ES-2. Table ES-1 identifies (for each parameter and for each station on a water body) whether individual parameters exceed the screening criteria, do not exceed the screening criteria, or can not be evaluated because of insufficient data. Table ES-2 provides the following information for parameters exceeding the screening criteria:

- Number of measurements
- Average value of measurements
- Maximum and minimum values measured
- Screening criteria
- Number of measurements exceeding the screening criteria

Presented below is a discussion of the most significant findings of the water quality data review for major water bodies in the basin.

Wright Patman Lake

Wright Patman Lake is on the 303(d) list because of low dissolved oxygen (DO) concentrations near the dam and in the headwaters of the reservoir. The further evaluation of the data conducted for this report confirms that occasional low DO concentrations do occur. The low concentrations are more frequent in the headwaters and upper end of the lake. There are very few identified point or nonpoint sources of pollutants near the headwaters of the lake. It is recommended that further studies be conducted to determine whether the observed conditions are impacting water uses, the location and significance of point and nonpoint sources, and/or whether the observed quality is a result of naturally occurring conditions.

Table ES -1

**SULPHUR RIVER BASIN
SCREENING PROGRAM RESULTS 1999 BASIN SUMMARY REPORT**

Subwatershed	Segment	Station ID	Conventional Parameters											Metals and Cyanide in Water													
			Temp	pH	DO	Chl a	TP	DP	FC	Cl	SO ₄	TDS	NO ₂ +NO ₃	NH ₃ -N	Ag	Al	As	Cd	Cr	Cu	CN	Mn	Ni	Pb	Se	Zn	
Wright Patman Lake Subwatershed	301	10212																									
		13783																									
	302	14097																									
		14099																									
		14100																									
		14102																									
		14103																									
		14104																									
Sulphur River Subwatershed	303	10215																									
		10199																									
White Oak Creek Subwatershed	303	10198																									
Days Creek Subwatershed	304	10226																									
		15256																									
		15342																									
North Sulphur River Subwatershed	305	10197																									
		10231																									
South Sulphur River Subwatershed	303	10222																									
		10234																									
		10238																									
		13632																									
	307	13855																									
		13856																									
		13857																									
13858																											

Note: Period of data evaluated is approximately 1993-1997. Exact dates vary by station.

Table ES-2

White Oak Creek

Fourteen percent (six of 42 samples) of the DO measurements in White Oak Creek were below the screening criteria at TNRCC Station 10198 (White Oak Creek at U.S. Highway 259, north of Omaha). Flow data for this station are not available; however, all of the measurements below the screening criteria occurred during the summer months when low-flow conditions are typical. The screening criteria and presumed DO standard for White Oak Creek is 5.0 milligrams per liter (mg/L) because it is an unclassified perennial water. However, previous studies have determined that some East Texas streams do not maintain a 5.0 mg/L DO concentration under natural conditions during low-flow periods. A study of White Oak Creek should be conducted to determine if a 5.0 mg/L DO standard is appropriate.

Sulphur River and South Sulphur River Between Wright Patman Lake and Cooper Lake

Segment 303 of the Sulphur River was placed on the 303(d) list in 1998, and is proposed to be included on the 1999 list, because of low DO concentrations in the lower reach of the segment. However, the data screened for this evaluation do not indicate that there are significant exceedances of the DO criteria. The stream standard for DO is a daily average concentration of 5.0 mg/L. From August 1992 until April 1998, the only measurements of less than 5.0 mg/L were two measurements of 4.9 mg/L DO. These two measurements are each below the stream standard by 0.1 mg/L. If only data for the five-year period 1993-1997 are evaluated, less than 10 percent of the measurements do not meet the criteria. Further, these readings are instantaneous readings and not 24-hour average values, on which the standards are based. It is recommended that the listing of Segment 303 for DO be deleted.

Segment 303 is included on the 303(d) list for exceedances of the acute aluminum (Al) criteria in the lower reach of the segment. However, the water quality standard applies to the dissolved fraction of the Al present in the stream, and none of the dissolved Al measurements in 1993-1997 exceed the criteria. A total Al concentration of 1810 mg/L was measured on February 4, 1998. It is presumed that this measurement was the basis of the 303(d) listing because there is no established method for estimating what fraction of the total Al present is in the dissolved state. However, on February 4, 1998, dissolved Al was also measured and found to be <41 mg/L; so, data conversion is not needed. The dissolved Al measurement documents that there was no exceedance of the Al criteria. Segment 303 should not be listed for Al on the 303(d) list. It is recommended that this listing be deleted.

Segment 303 is also included on the 303(d) list for cadmium (Cd). However, neither the preliminary screening performed by TNRCC on the 1993-1997 data nor the screening conducted for this assessment report identified any measurements of Cd in water that exceed the acute criteria. Therefore, Segment 303 should not be listed for Cd on the 303(d) list. It is recommended that this listing be deleted.

Big Creek Lake

Big Creek Lake is in the Sulphur River watershed. Big Creek Lake is included on the 303(d) list because of the detection of atrazine in the finished drinking water of a water supply system that uses Big Creek Lake as their source of supply. Currently, the drinking water meets all quality requirements for a public water supply. However, there is a concern that atrazine concentrations could increase in the future and impair the water supply. Therefore, TNRCC is recommending that atrazine concentrations in Big Creek Lake be addressed by a TMDL study.

BASIN PLANNING .

The segments in the Sulphur River Basin receiving the most focused attention with regard to water quality concerns at the present time are Segment 302 (Wright Patman Lake), Segment 303 (Sulphur River and South Sulphur River), and Big Creek Lake in the watershed of Segment 303. These segments are currently listed on the 303(d) list. Other water quality conditions that warrant further study are DO concentrations in White Oak Creek and nutrient impacts in Cooper Lake and the South Sulphur River above Cooper Lake.

A Preliminary Basin Action Plan has been developed to address water quality issues in the basin. The Preliminary Basin Action Plan includes information, to the extent information is available, about water use impairments, parameters causing the impairment, suspected sources of the pollutant(s) of concern, and actions that have been taken to address the water quality issues. By July 2000, after discussion with the Sulphur River Basin Steering Committee about priorities and potential actions that can be taken, the final Basin Action Plan will be available, which will include recommended actions.

RECOMMENDATIONS

Recommendations for future activities in the Sulphur River Basin include the following:

- Develop recommended actions for water quality issues identified on the Preliminary Basin Action Plan.
- Establish priorities and conduct monitoring to address concerns identified in the Significant Findings, and investigate further water quality conditions in Cooper Lake, the Sulphur River above Cooper Lake, and White Oak Creek. The Wright Patman Lake watershed has been selected as a priority monitoring area for FY 2000.
- Implement monitoring programs to provide better assessments of the extent to which uses are being supported in water bodies where data are currently limited or non-existent.
- Investigate funding sources to support expanded monitoring activities in the basin.
- Enhance coordination of monitoring programs in the Sulphur River Basin, and determine the interest of local entities in participating in the CRP monitoring program.
- Continue to provide opportunities for public involvement.
- Contribute to the development of balanced, scientifically-based management programs for waters not supporting designated uses by providing technical data and opportunities for public involvement in the process to develop the programs.

CHAPTER I

INTRODUCTION

The Sulphur River Basin Fiscal Year (FY) 1999 Summary Report has been prepared by the Sulphur River Basin Authority (SRBA) for the Texas Clean Rivers Program administered by the Texas Natural Resource Conservation Commission (TNRCC). This Summary Report reviews the activities and accomplishments of the Clean Rivers Program (CRP) in the Sulphur River Basin since the last report on October 1, 1996, and provides an updated assessment of water quality in the basin.

TEXAS CLEAN RIVERS PROGRAM

In May 1991, the 72nd Texas Legislature enacted Senate Bill 818, known as the Clean Rivers Act. This Act requires the TNRCC to ensure the performance of regional assessments of water quality on a watershed basis. In response to the legislation, the TNRCC adopted permanent rules initiating the Clean Rivers Program in December 1991. The assessment process is conducted as a cooperative effort between the TNRCC and local partners, primarily river authorities. The local partners, under the supervision of the TNRCC, conduct regional assessments of watersheds within their jurisdiction. The SRBA assumed responsibility for assessing the watersheds within the Sulphur River Basin. Initially, these regional assessments were conducted biennially. SRBA submitted biennial assessments on October 1, 1992; October 1, 1994; and October 1, 1996.

In January 1995, in accordance with requirements established by the Texas Legislature, TNRCC adopted rules whereby, to the extent practical, they would issue all permits in a single river basin within the same year. To distribute the workload for permit issuance, each river basin has been placed in one of five groups (Groups A through E). Each year permits are issued for dischargers in the basins in one of the designated groups. Every five years, the basin permitting cycle starts over.

In 1997, TNRCC modified the CRP so it would provide site-specific data to support the issuance of permits with limits based on actual conditions rather than presumptions. A five-year planning cycle was

established for each basin that coincides with the basin permitting cycle. The focus of each year of the planning cycle is as follows:

- Year 1 - Scoping and problem identification
- Year 2 - Data collection
- Year 3 - Assessment and targeting
- Year 4 - Strategy development
- Year 5 - Implementation, including permit issuance

The Sulphur River Basin is in Group A. In FY 1999, Group A is in the Assessment Phase. In this phase, the most recent five years of water quality data are compiled and analyzed. A Basin Summary Report, this report, is prepared that summarizes the results of the assessment. Next year, the data in this report and subsequent studies will be used to develop information to support the development of permits in the Sulphur Basin, which are scheduled for re-issuance in FY 2001. Other implementation recommendations may also be developed for FY 2001; for example, implementing pretreatment programs, or obtaining grant funds for nonpoint source projects. These recommendations will be developed in FY 2000 in the Strategy Development Phase.

The SRBA FY 1999 goals for the CRP in the Sulphur River Basin are as follows:

- Analyze water quality data in the Sulphur River Basin.
- Recommend additional monitoring or management programs based on current analyses.
- Initiate annual coordinated monitoring meetings for all entities monitoring in the Sulphur River Basin who presently, or potentially could, come under the Quality Assurance Project Plan for the basin. The objective of these meetings is to eliminate duplication of efforts among entities and, thereby, benefit the public through decreased costs and/or increased monitoring.
- Conduct monitoring in priority areas, as resources allow, to assess potential areas of water quality impairment. If impairments are confirmed to be present, future monitoring programs may be conducted to determine the extent and significance of the impairment, isolate potential source areas, evaluate potential control strategies, and evaluate the effectiveness of control strategies.
- Integrate new data, land use information, and information on events that may affect water quality into concise summaries, maps, and tables; and use these data to prepare a more comprehensive evaluation of factors affecting water quality in the basin.

Since 1996, SRBA has concentrated its activities on the following areas:

- Expanding Sulphur River Basin information including the water quality database and, as relevant, site location information and basin events such as major storms, droughts, and reservoir construction. (Appendix E)
- Developing basin maps to depict new information and convey to the public the water quality conditions in the Sulphur River Basin.
- Conducting local meetings to set local priorities for evaluation and basin monitoring.
- Setting up an Internet web page (www.sulphurr.org) to disseminate basin information, including reports, meeting notices, and data.
- Conducting basin monitoring, including partnering with the United States Geological Survey (USGS) to provide a fixed monitoring station on the Sulphur River; conducting a receiving water assessment to support development of a wastewater discharge permit; and assisting in an intensive study of Rock Creek in the Sulphur River watershed. The receiving water assessment and intensive survey were conducted to assist cities in the basin with wastewater discharge permits.
- Coordinating monitoring by entities in the basin that meet data quality assurance objectives of the CRP, and determining if there are additional entities who are willing to conform to the program quality assurance goals.
- Recommending approaches for problem identification.

PURPOSE OF SUMMARY REPORT

The Basin Summary Report is a comprehensive report of water quality and watershed conditions in the Sulphur River Basin. The purpose of the report is to communicate with a local and statewide audience regarding basin water quality issues and trends. The report also describes programs to analyze and protect water quality.

More frequent reports on specific topics related to water quality in the Sulphur River Basin are provided in annual Basin Highlights Reports. In addition, basin information and reports are available to the public on the Internet through the CRP Sulphur River Basin web page.

DESCRIPTION OF BASIN

The Sulphur River Basin includes area in 11 counties in the northeast corner of Texas. The basin includes all of Delta County and portions of Bowie, Cass, Fannin, Franklin, Hopkins, Hunt, Lamar, Morris, Red River, and Titus Counties. A map of the basin is presented on Figure I-1.

The largest city in the study area is Texarkana in Bowie County. Other major population centers include Clarksville, Commerce, Cooper, Paris, Mount Vernon, New Boston, Sulphur Springs, and Wake Village.

The basin land use is primarily open lands with approximately 90 percent of the area made up of grassland, cropland, and woodland. Urban land uses occupy approximately four percent of the land; greater than two percent of the land is public and recreation lands; and almost three percent of the land is covered by water.

Figure I-1

Economic activities of importance to the Sulphur River Basin include chemical manufacture, petroleum production, lignite mining, paper products manufacture, fabricated metal products manufacture, food products production, dairies, recreation, military activities, government services, agriculture, consumer products and services, timber harvesting, and educational institutions.

Rainfall varies from an average of 40 inches per year in the western part of the basin to 48 inches per year in Texarkana. Temperatures in the basin tend to be moderate. The mean maximum July temperature is in the range of 93-95 Fahrenheit (F), and the mean minimum temperature in January is in the range of 30-35 F.

The Sulphur River has two major headwater streams and a number of tributaries. The North and South Sulphur Rivers both originate in southern Fannin County and flow eastward. The Middle Sulphur River also originates in Fannin County and joins the South Sulphur River in Delta County at Cooper Lake. The South Sulphur River converges with the North Sulphur River to form the Sulphur River just upstream of the Franklin/Red River County line. The Sulphur River continues eastward into Wright Patman Lake and exits Texas south of Texarkana, where it flows into the Red River within Arkansas. Days Creek, a tributary stream, collects drainage from a large percentage of the area of Texarkana, Texas, flows south of the city and enters Arkansas before merging with the Sulphur River. The Sulphur River drains an area of approximately 3,558 square miles in Texas.

The Sulphur River Basin has been divided into seven classified segments (Segments 301 through 307) by the TNRCC. Figure I-2 depicts the segments in the Sulphur River Basin. Five segments are stream segments; Segment 302 is Wright Patman Lake; and Segment 307 is Cooper Lake. The largest tributary of the Sulphur River is White Oak Creek.

Stakeholders within the basin include municipalities, industries, water districts, the public, and conservation groups. There are a number of water districts with interests in the basin including those that service Sulphur River Basin citizens and those that supply water to citizens in other watersheds. The water districts are the SRBA, the Sulphur River Municipal Water District (SRMWD), and the North Texas Municipal Water District (NTMWD). In addition, the Upper Trinity Regional Water District (UTRWD) has entered into an agreement with the City of Commerce for temporary interim purchases

Figure I-2

of water from Commerce's share of Cooper Lake water. The SRBA has territorial jurisdiction in the entire river basin except for that portion contained in Fannin County.

The SRMWD serves Delta, Hopkins and Hunt counties and owns 26.28 percent of the water stored in Cooper Lake. The SRMWD supplies water to the Cities of Cooper, Commerce, and Sulphur Springs.

The NTMWD serves Dallas, Rockwall, Collin, and Kaufman Counties and is part owner of Cooper Lake. The NTMWD has an intake structure and pipeline from Cooper Lake to Lake Lavon. The NTMWD intake structure is also used by SRMWD.

The Red River Compact apportions waters of the Red River, Sulphur River, and Cypress River and their tributaries to their signatory states of Arkansas, Oklahoma, Louisiana, and Texas. The apportionment of water is based on a percentage of flows or specific volumes of existing reservoirs within specified reaches.

SUBWATERSHED SUMMARIES

The Sulphur River Basin has been divided into six subwatersheds for evaluation. The six subwatersheds are as follows:

- North Sulphur River Subwatershed
- South Sulphur River Subwatershed
- Sulphur River Subwatershed
- Wright Patman Lake Subwatershed
- White Oak Creek Subwatershed
- Days Creek Subwatershed

In the following sections the characteristics of each subwatershed are presented. The characteristics of the subwatersheds that are described include physical characteristics, land use, and population data.

North Sulphur River Subwatershed

The North Sulphur River extends upstream from its confluence with the South Sulphur River in Lamar County. The North Sulphur River is classified as Segment 305 by TNRCC. The segment extends from the confluence of the North Sulphur River with the South Sulphur River to 6.7 kilometers (4.2 miles) upstream of Farm-to-Market (FM) Road 68, in Fannin County. The subwatershed lies in the southeastern corner of Fannin County and the southern half of Lamar County. Drainage to the North Sulphur River is primarily from the north from many small tributary streams. These streams include Auds Creek and Big Sandy Creek.

The subwatershed lies in Ecoregion 32, Texas Blackland Prairie. The land surface in the area is irregular plains. Soils are vertisols, and original vegetation may include big and little bluestem, indian grass, switchgrass, sideoats grama, hairy grama, tall drop seed, Texas wintergrass, blue grama and buffalograss.

The downdip portion of the Trinity Aquifer, a major aquifer, underlies the subwatershed. The Woodbine Aquifer, a minor aquifer, also underlies the subwatershed.

Land use is primarily cropland and pasture. Some dairies are located south of Paris and in Fannin County. A section of the Caddo Nation Grassland is located west of Ladonia, on the south side of the North Sulphur River.

There are four permitted discharges in this subwatershed, two municipal and two industrial. Urbanized areas include Paris, Honey Grove, Roxton, and portions of Ladonia and Pecan Gap. A number of smaller communities are located throughout the subwatershed. The population in Segment 305 in 1990 was approximately 24,400. The population is estimated to grow nineteen percent by 2000, thirty-four percent by 2010, and fifty-five percent by 2020. Population tables are included in Appendix D.

South Sulphur River Subwatershed

The South Sulphur River extends from the confluence with the North Sulphur River upstream to the headwaters of the South Sulphur River in Fannin County. The South Sulphur River subwatershed includes all, or part, of three segments designated by TNRCC. These are the Upper South Sulphur River above Cooper Lake (Segment 306), Cooper Lake (Segment 307), and the South Sulphur River below Cooper Lake (upstream portion of Segment 303). The Middle Sulphur River is a major tributary to Cooper Lake, and a number of smaller streams are lesser tributaries to Cooper Lake and the South Sulphur River.

Drainage to the South Sulphur River is primarily from the north. Tributaries, in addition to the Middle Sulphur River, include Spring, Pecan, Jennings, Doctors, and Big Creeks. Cities within the South Sulphur subwatershed include Commerce, Cooper, and a portion of Ladonia. Smaller cities include Bailey and a portion of Pecan Gap.

The portion of the subwatershed in Fannin County overlies a major aquifer, the Trinity Aquifer. The subwatershed also overlies a minor aquifer, the Woodbine Aquifer.

The subwatershed lies in Ecoregion 32, Texas Blackland Prairie. The land surface in the area is irregular plains. Soils are vertisols, and original vegetation may include big and little bluestem, indian grass, switchgrass, sideoats grama, hairy grama, tall drop seed, Texas wintergrass, blue grama and buffalograss.

Land use within this subwatershed is about equally divided between cropland and rangeland, outside of the urbanized areas. In general, the rangeland is found north and south of the City of Commerce in the Middle Sulphur River watershed and the downstream portions of the Upper South Sulphur River. On the south side of Cooper Lake, in Hopkins County, there are some dairies.

Segment 306 – Upper South Sulphur River

The Upper South Sulphur River, Segment 306, extends from 1 kilometer (0.7 miles) upstream of SH 71 in Delta/Hopkins County upstream to SH 78 in Fannin County. The watershed for this segment includes the cities of Commerce and Wolfe City. There are two permitted municipal discharges in this sub-subwatershed.

The population of Segment 306 was approximately 14,900 in 1990. Population is predicted to increase nineteen percent by 2000, thirty-two percent by 2010, and forty-five percent by 2020 (Appendix D).

Segment 307 – Cooper Lake

Cooper Lake, Segment 307, extends from the Cooper Lake Dam in Delta/Hopkins County to a point 1 kilometer (0.7 miles) upstream of SH 71 on the South Sulphur River arm of the lake, and to a point 300 meters (275 yards) below the confluence of Barnett Creek on the Middle Sulphur River arm of the lake. Drainage directly to the lake is mainly from the north. Cooper Lake covers 19,000 acres. There are three permitted municipal discharges in the watershed for this segment.

The population of Segment 307 was approximately 11,400 in 1990. Population is projected to increase nineteen percent by 2000, forty-two percent by 2010, and forty-nine percent by 2020.

Segment 303 - South Sulphur River

This portion of Segment 303 begins at the confluence of the South Sulphur River with the North Sulphur River on the Delta/Lamar County line and continues upstream to Cooper Dam. Only small communities are located in this watershed, and the land use is primarily cropland. There are no permitted discharges in this portion of the watershed of Segment 303.

Sulphur River Subwatershed

The subwatershed designated Sulphur River consists of that portion of Segment 303 that extends from 1.5 kilometers (0.9 miles) downstream of Bassett Creek in Bowie/Cass County to the confluence of the North and South Sulphur Rivers in Delta/Lamar County. This subwatershed includes portions of Bowie, Red River, Lamar, Franklin, Titus, Morris, and Cass Counties. It encompasses about twenty-five percent of the land area of the basin. Primary tributaries to the Sulphur River include Bassett, Cuthand, Mustang, and Little Mustang Creeks. White Oak Creek, which is a major tributary to the Sulphur River, has been designated as a separate subwatershed.

This subwatershed lies in Ecoregions 29 (Central Oklahoma/Texas Plains), 33 (East Central Texas Plains), and 35 (South Central Plains). The land surface in all of these ecoregions is classified as irregular plains.

Ecoregion 29 consists of alternating woodlands and prairies. Typical native grasses in this region include big bluestem, little bluestem, hooded wind-mill grass, indiangrass, switchgrass and many species of legumes. Woody vegetation includes shinnery, blackjack, post oak and live oak. The soils are primarily affisols.

Ecoregion 33 is a forest region. The principal trees found are post oak, blackjack oak and elm. Pecans, walnuts and other water-demanding trees line the streams. Typical native grasses consist of little bluestem, big bluestem, indiangrass, switchgrass, purpletop, silver bluestem, Texas wintergrass, spike wood-oats, and longleaf wood oats. Soils in this area are primarily dry affisols.

In Ecoregion 35 there are three native species of pines: longleaf, shortleaf, and loblolly. Hardwoods present include a variety of oaks, elm, hickory, and magnolia. The soils are primarily ultisols.

The downstream half of the subwatershed includes portions of the Carrizo-Wilcox Aquifer recharge area. The subwatershed also overlies a minor aquifer, the Nacatoch Aquifer.

Land use is primarily cropland. Forested areas exist along the Sulphur River and in Red River County north of Bogata. There is some petroleum production in Red River and Titus Counties.

A number of cities are located in this watershed including Annona, Bagwell, Blossom, Clarksville, Detroit, Deport, and Talco. The subwatershed has seven permitted municipal discharges. The population was approximately 56,300 in 1990. Population is projected to increase six percent by 2000, seventeen percent by 2010, and thirty-six percent by 2020 from 1990 levels.

White Oak Creek Subwatershed

This subwatershed is a large tributary stream to the Sulphur River, Segment 303, above Wright Patman Lake. White Oak Creek extends from its confluence with the Sulphur River in Cass County upstream into Hopkins County. The subwatershed includes portions of Hopkins, Franklin, Titus and Morris Counties and a very small portion of Cass County. This subwatershed contains approximately twenty-five percent of the land area in the Sulphur River Basin. White Oak Creek is an unclassified stream segment.

The White Oak Creek subwatershed lies in Ecoregions 32, 33, and 35. Each of these ecoregions is described briefly below.

In Ecoregion 32, the land surface is irregular plains. The soils are vertisols, and original vegetation may include big and little bluestem, indian grass, switchgrass, sideoats grama, hairy grama, tall drop seed, Texas wintergrass, blue grama and buffalograss.

Ecoregion 33 is a forest region. The principal trees found are post oak, blackjack oak and elm. Pecans, walnuts and other water-demanding trees line the streams. Typical native grasses consist of little bluestem, big bluestem, indiagrass, switchgrass, purpletop, silver bluestem, Texas wintergrass, spike woodoats, and longleaf wood oats. Soils in this area are primarily dry affisols.

In Ecoregion 35 there are three native species of pines: longleaf, shortleaf, and loblolly. Hardwoods present include a variety of oaks, elm, hickory, and magnolia. The soils are primarily ultisols.

This subwatershed overlies the Carrizo-Wilcox Aquifer. Land use in the White Oak Creek subwatershed consists of cropland, forestlands along the stream, and isolated areas of dairy farms, petroleum production, and mining. The petroleum production is located along the northern edge of the watershed in Hopkins, Franklin, and Titus Counties.

There are four municipal and two industrial discharges permitted in this subwatershed. Urbanized areas include Sulphur Springs and Mount Vernon. Population is projected to increase seventeen percent by 2000, thirty-two percent by 2010, and fifty-three percent by 2020 from 1990 levels.

Wright Patman Lake Subwatershed

This subwatershed includes Segment 301 of the Sulphur River and Wright Patman Lake. Wright Patman Lake is designated as Segment 302 by the TNRCC. The major tributaries in this subwatershed are Anderson Creek, Big Creek, and Elliot Creek.

The subwatershed lies in Ecoregion 35 (South Central Plains) and is in the Carrizo-Wilcox Aquifer recharge zone. In Ecoregion 35 there are three native species of pines: longleaf, shortleaf, and loblolly. Hardwoods present include a variety of oaks, elm, hickory, and magnolia. The soils are primarily ultisols.

Land use in the subwatershed is primarily forests and cropland. However, within this watershed lies the Red River Army Depot and Lone Star Army Ammunition Plant. These facilities are located in Bowie County north of the lake. EPA has a Superfund Site at the Lone Star Army Ammunition Plant site due to elevated levels of mercury, chromium, and lead in soil and groundwater.

The cities of DeKalb, Maud, New Boston, and Redwater are within the subwatershed. This subwatershed contains five municipal and four industrial permitted discharges. The population in the watershed was approximately 21,900 in 1990. Population within the watershed is expected to grow seven percent by 2000, nineteen percent by 2010, and thirty-eight percent by 2020 from 1990 levels.

Segment 302 – Wright Patman Lake

The watershed of Wright Patman Lake extends from the Wright Patman Dam in Bowie/Cass County upstream to 1.5 kilometers (0.9 miles) downstream of Bassett Creek in Bowie/Cass County. The dam impounds the Sulphur River to a normal pool elevation of 225 feet mean sea level (msl). The total drainage area contributing to Wright Patman Lake is approximately 3,443 square miles. The surface area of the lake is 20,300 acres.

Segment 301 – Sulphur River below Wright Patman Lake

The Sulphur River below Wright Patman Dam receives flow from Wright Patman Lake and runoff from the surrounding forestland and agricultural areas. Flow is controlled by the releases from the lake. No significant urban runoff is contributed to this section of the river, but the southern outlying area of Texarkana drains to the river. Segment 301 begins at Wright Patman Dam and continues east to the Texas/Arkansas State Line.

Days Creek Subwatershed

Days Creek is in the northeast corner of the Sulphur River Basin. The subwatershed consists of Days Creek and its tributaries. The classified portion of Days Creek, designated Segment 304 by TNRCC, starts at the Texas/Arkansas border and continues upstream to the confluence of Nix and Swampoodle Creeks. Tributaries to Days Creek include Cowhorn, Howard, Nix, Rocky, Swampoodle and Waggoner Creeks. Nix and Rocky Creeks are primarily in Arkansas.

The subwatershed is within Ecoregion 35, South Central Plains, and is in the Carrizo-Wilcox Aquifer recharge zone.

In Ecoregion 35 there are three native species of pines: longleaf, shortleaf, and loblolly. Hardwoods present include a variety of oaks, elm, hickory, and magnolia. The soils are primarily ultisols.

The Days Creek subwatershed is primarily an urbanized watershed. Most of the City of Texarkana is in the subwatershed. The subwatershed also includes portions of Nash and Wake Village. There are two municipal and two industrial permitted discharges and a number of additional industrial facilities in the Days Creek subwatershed.

The population was approximately 18,500 in Texas in 1990. However, the 1990 population of the metropolitan area, including the Arkansas portion, was 120,000. Population within the subwatershed is rapidly growing with a projected nineteen percent increase by 2000, thirty-three percent increase by 2010, and a fifty percent increase by 2020 from 1990 levels.

WATER QUALITY IN THE BASIN

For this assessment, approximately five years of water quality data were analyzed (through Spring 1998). A complete summary of the assessment results is presented in Chapter IV. Water quality in the Sulphur River Basin is generally good. However, the following waters are currently classified as threatened or impaired on the list prepared by TNRCC pursuant to Section 303(d) of the Clean Water Act (CWA) [303(d) list]: Segment 302 (Wright Patman Lake), Segment 303 (Sulphur River and South Sulphur River), and Big Creek Lake in the watershed of Segment 303.

Wright Patman Lake is currently on the 303(d) list because of occasional low concentrations of DO both near the dam and in the upper end of the lake. Additional investigations of dissolved oxygen (DO) concentrations in Wright Patman Lake are required to determine whether uses are being impaired as a result of the conditions observed, to identify potential sources of pollutants, and to identify quality variations attributable to natural conditions.

Additional investigations of DO concentrations in the Sulphur River between Wright Patman Lake and Cooper Lake are also needed. This section of the river is on the 303(d) list for DO. Data to address this issue are being obtained by the SRBA FY 1999 Systematic Monitoring Program.

Segment 303 is also included on the 303(d) list because of reported elevated concentrations of dissolved aluminum and cadmium. However, the data evaluated for this report do not support the listing of Segment 303 for either aluminum or cadmium. The SRBA FY 1999 Systematic Monitoring Program is gathering additional data to better characterize the quality of Segment 303 with respect to aluminum and cadmium.

Big Creek Lake is located north of Cooper on Big Creek, a tributary to the South Sulphur River. It is listed on the 303(d) list due to atrazine concentrations in the drinking water produced from the lake. The drinking water produced is currently compliant with the Safe Drinking Water Act criteria. However, if atrazine concentrations continue to increase, they could become a threat to the future use of the lake as a water supply.

Other water bodies also exhibit characteristics that warrant further investigation to determine if uses are being impaired. A determination is needed regarding whether the DO concentrations in White Oak Creek are low as a result of natural conditions or the action of man. In Cooper Lake and the South Sulphur River above Cooper Lake, a study is recommended to determine whether the observed concentrations of nutrients are impacting water uses.

COORDINATION WITH OTHERS

The lead agencies participating in the Sulphur River Basin assessment are the TNRCC and the SRBA. The Sulphur River Basin Steering Committee has also assisted in the coordination and development of this assessment. This committee was established to help identify significant water quality issues within the basin, to make available to the SRBA all relevant water quality data held by represented entities, to provide assistance in the development of CRP activities, and to help develop Sulphur River Basin resources for the residents of the basin. The SRBA Board of Directors also provided active direction to this assessment.

As part of the CRP program, the SRBA coordinates with a number of entities regarding monitoring in the Sulphur River Basin. To develop the CRP basin-wide monitoring program for the Sulphur River Basin, the SRBA hosted a basin monitoring coordination meeting. In attendance were representatives of the USGS, the TNRCC Surface Water Quality Monitoring (SWQM) team in Austin, and the TNRCC District 5 office in Tyler. Existing monitoring programs were examined, and more cost-effective methods of monitoring were discussed. This process will continue in the future. Annual meetings will be held to identify a coordinated approach to achieving monitoring objectives in the basin. Attendance at the meetings by all entities collecting basin data, who meet the quality assurance protocols for the Sulphur River Basin, will be sought.

Additionally, the SRBA coordinates with TNRCC and the other river authorities to implement standardized sample collection and analysis protocols for monitoring. As a result of these efforts, progress is being made in achieving a coordinated statewide monitoring program, and consistent quality control procedures are utilized statewide and basinwide.

PUBLIC INVOLVEMENT

Public outreach for the CRP in the Sulphur River Basin has been through contacts of the Steering Committee and the SRBA Board of Directors. Materials distributed or available for distribution include the Basin Highlights Reports

and basin maps depicting basin uses, monitoring locations, and water quality concerns. The public also has direct access to Sulphur River Basin information through the basin Internet web page. On the Internet, reports, maps, and data are available, as well as electronic mail links to the SRBA and its consultant for the Clean Rivers Program.

The Sulphur River Basin Steering Committee has provided input to the Sulphur River Basin CRP since its inception. The Steering Committee consists of representatives from water districts, cities, state agencies, federal agencies, local governmental organizations, utilities, and local interested parties.

Other water quality-related programs that involve the public in the Sulphur River Basin include Texas Watch volunteer monitoring and volunteer monitoring sponsored by the Ark-Tex Council of Governments. Citizens who participate in these programs develop a better understanding and appreciation of water resources in the basin.

CHAPTER II

PUBLIC INVOLVEMENT

Public involvement and outreach are an important component of the Clean Rivers Program (CRP). Through public outreach, individuals, businesses, agricultural interests, and municipalities located within the Sulphur River Basin become aware of their potential impacts on area creeks, rivers, and lakes. Also, through contact with the public the Sulphur River Basin Authority (SRBA) may learn about site-specific issues and gather information on events that may affect water quality. The Texas Natural Resource Conservation Commission (TNRCC) has emphasized public involvement as an element of the CRP. The SRBA Board of Directors has increased public involvement through an expanded steering committee and development of a Sulphur River Basin web page on the Internet. A list of current SRBA Board of Directors is included in Appendix A.

PUBLIC OUTREACH

Public outreach in the Sulphur River Basin is mainly through the SRBA Board of Directors and the Sulphur River Basin CRP Steering Committee. SRBA Directors and Steering Committee members provide interested citizens with CRP reports or maps when requested. They also advise citizens of the Sulphur River Basin web page on the Internet or refer questions about the CRP to the SRBA consultant. The Internet web page provides recent reports, data, and maps of the basin. In addition to accessing data through the web page, citizens also may ask questions or make comments regarding the CRP using electronic mail to communicate with the SRBA's CRP consultant.

Citizen awareness is also increased by citizen monitoring. Volunteer monitoring occurs primarily in the eastern portion of the basin near Wright Patman Lake and Texarkana where the population is most concentrated. Volunteer monitoring has grown in the basin. Several groups at Texarkana College monitor creeks in Texarkana and tributaries to Wright Patman Lake. The Ark-Tex Council of Governments (Ark-Tex COG) sponsors volunteer monitoring along the North Shore of Wright Patman Lake, and an individual volunteer monitors Wright Patman Lake at the Redwater Bridge. The Ark-Tex COG uses TNRCC 604(b) grant funds to support these monitoring efforts.

STEERING COMMITTEE

The Steering Committee's role in the water quality assessment process is to provide information and guidance for goal and objective development. The Steering Committee has assisted with identifying and prioritizing water quality concerns. The Steering Committee provides public input and review during the development of work plans, basin monitoring plans, and assessment reports. The committee is a valuable part of the water quality assessment process.

The SRBA Steering Committee is composed of representatives from state and local governmental agencies, political subdivisions, and private industry, as well as individuals with expressed interest in and/or knowledge of the local water quality conditions. A list of current Steering Committee members is included in Appendix B.

The SRBA held its most recent Steering Committee meetings for the Sulphur River Basin on August 21, 1998, and on April 23, 1999. The purpose of the August 1998 meeting was to discuss the CRP activities in Fiscal Year (FY) 1998 and plan for FY 1999. The Steering Committee was told of the Sulphur River Basin web page that is available on the Internet and of the ability of the public to access the SRBA's CRP program through electronic mail. Proposed FY 1999 monitoring by SRBA and TNRCC was also discussed. Comments received from the Steering Committee on the CRP included the following:

- I-2_ Use of the Internet web page and local television interviews with volunteer monitors are encouraged to achieve public education and outreach;
- Dairies should be added to list of sites to be located using the global positioning system in the future; and
 - The monitoring program should concentrate rapid bioassessment efforts in the watershed of Segment 303 of the Sulphur River in FY 1999.

Steering Committee members were requested to provide any information they may have on basin Aevents@ such as spills, development, leaking septic systems, flooding, etc. This information is being compiled in the SRBA database and on basin maps and will be used in basin analyses. The Sulphur River Basin Steering Committee has been a valuable resource to the basin. SRBA looks forward to providing further opportunities for involvement of the Steering Committee in the Sulphur River Basin CRP.

CHAPTER III

BASIN WATER QUALITY

This chapter describes the monitoring program for the Sulphur River Basin and the results of the monitoring program. A general summary of water quality in the basin is presented in this chapter. More detailed descriptions of water quality in individual water bodies are provided in Chapter IV.

MONITORING PROGRAM

Basin-wide monitoring programs provide the basis for effective watershed management. This section of the assessment report describes the historical monitoring program that provides the data used to evaluate existing water quality in the basin. It also discusses current monitoring programs.

Historical Monitoring Program

Five years of water quality data were screened to evaluate water quality conditions in the Sulphur River Basin. The monitoring stations that provided data for the evaluation are identified in Table III-1. The locations of these stations are shown on Figure III-1.

Current Monitoring Program

Each year the Sulphur River Basin Authority (SRBA) reviews and, as appropriate, revises the basin-wide monitoring plan. In the development of this plan, existing monitoring programs, historical data, Steering Committee comments, public input, and priority issues within the basin are considered. The SRBA also consults and coordinates with other entities that conduct monitoring in the basin. Basin-wide monitoring plan objectives, as identified by the Texas Natural Resource Conservation Commission (TNRCC), include providing three types of water quality monitoring: fixed station monitoring, systematic monitoring, and targeted monitoring. This chapter briefly describes the recent and current water quality monitoring activities in the Sulphur River Basin for each of these three types of monitoring programs.

Table III-1

Figure III-1

Fixed Station Monitoring

An objective of fixed station monitoring is to identify long-term trends. This type of monitoring also documents overall water quality characteristics. The parameters measured help to determine impacts of point and nonpoint sources and are used to evaluate compliance with water quality standards. The water quality data generated from these stations are utilized by the TNRCC when preparing the Biennial Water Quality Assessment required by the U.S. Environmental Protection Agency (EPA) pursuant to Section 305(b) of the Clean Water Act. TNRCC guidance for monitoring plan development suggests that each classified stream segment should have at least one fixed monitoring station. Fixed monitoring stations should be maintained for at least five years.

The Fiscal Year (FY) 1999 fixed monitoring program is similar to the fixed monitoring program conducted in previous years. In FY 1999, the U.S. Geological Survey (USGS) is operating nine stations, and the TNRCC, is operating twelve stations. Water quality at each station is measured at least quarterly; field and routine chemical analyses are conducted during each sampling event. Table III-2 describes the fixed monitoring stations in the Sulphur River Basin; it identifies the types of measurements and number of measurements proposed to be collected in FY 1999. Appendix C provides a list of the specific parameters measured by each agency.

Systematic Monitoring

The systematic monitoring program is a short-term monitoring program that seeks to identify previously unidentified water quality problems in water body locations that are not monitored routinely. A portion of the basin is screened each year. Over a five-year period, the entire basin is assessed. Systematic monitoring may provide more extensive data for classified segments or data for unclassified water bodies. Systematic monitoring is used as a screening program. That is, data are collected in sufficient quantities to allow a determination regarding whether a segment shows signs of being impaired. If there is evidence of impairment, targeted monitoring studies may be conducted subsequently to gain a better understanding of the significance and cause of the impairment. Systematic monitoring conducted as part of the Clean River Program (CRP) can provide valuable information to the TNRCC's program to develop Total Maximum Daily Loads (TMDLs).

Table III-2 page 1

TABLE III-2
SULPHUR RIVER BASIN
FY 1999 FIXED MONITORING PROGRAM

Station Description	Segment	Station ID	Latitude/ Longitude	Sampling Parameters and Frequency						
				Flow	Field	Conventional	Metals ^w	Metals ^s	Bact.	Organics ^s
Wright Patman Lake near dam	302	TNRCC 10213	33 18 00.0/ 94 12 00.0			4	4	1	4	--
Wright Patman Lake	302	TNRCC 15061	33 21 18.3/ 94 10 54.9			4	4	1		--
Wright Patman Lake at SH 8	302	TNRCC 10214	33 15 32.0/ 95 21 09.0			4	4	1	4	--
Wright Patman Lake near Atlanta State Park	302	TNRCC 16205	--	--	4	4	4	1	4	--
Sulphur River at US 67	303	TNRCC 10215	33 15 06.0/ 94 37 30.0	--	4	4	4	1	4	--
Sulphur River near Talco	303	USGS 7343200	--	--	6	6	2	1	--	--
S. Sulphur River near Cooper, TX	303	USGS 7342500	33 21 23.0/ 95 35 41.0	C	4	4	3	--	3	--
S. Sulphur River at SH 19 east of Cooper	303	TNRCC 10222	33 21 20.0/ 95 35 39.0	4	4	4	4	1	4	--
White Oak Creek near Talco, TX	303	USGS 7343500	33 19 20.0/ 95 05 33.0	C	6	6	2	--	2	--
White Oak Creek @ US 259	303	TNRCC 10198	33 16 30.0/ 94 44 30.0	--	4	4	4	1	4	--
Sulphur River near Talco	303	USGS 7343200	33 23 10.0/ 95 07 56.0	C	6	6	2	1	--	--
North Sulphur River at SH 24	305	TNRCC 10231	--	4	4	4	4	1	4	--
N. Sulphur R. at SH 24	305	USGS 7343000	--	C	3	3	--	--	--	--
S. Sulphur River near Commerce	306	USGS 7342470	33 13 11.0/ 95 51 45.0	4	4	4	2	--	2	--
S. Sulphur River at Commerce	306	USGS 7342465	33 12 42.0/ 95 54 50.0	C	4	4	2	--	--	--

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Station Description	Segment	Station ID	Latitude/ Longitude	Sampling Parameters and Frequency						
				Flow	Field	Conventional	Metals ^w	Metals ^s	Bact.	Organics ^s
Middle Sulphur River at Commerce	307	USGS 7342480	33 15 59.0/ 95 54 55.0	C	4	4	2	--	2	--
Cooper Lake near Cooper	307	USGS 7342495	33 19 38.0/ 95 37 47.0	--	3	3	--	--	--	--
Cooper Lake North of Peerless	307	TNRCC 15211	--	--	4	4	4	1	4	--
Cooper Lake at USGS Site AC	307	TNRCC 13855	--	--	4	4	4	1	4	--

^w in water

^s in sediment

C = continuous measurement

Table III-1 page 2

Systematic monitoring identifies potential water use impairments in the Sulphur River Basin based on an appropriate combination of water quality analyses, sediment quality analyses, and rapid bioassessments (RBA). RBA is a cost-effective, practical technique for detecting aquatic life impairments and assessing the relative severity of impairment. Protocols for conducting RBAs are contained in Rapid Bioassessment Protocols for Use in Streams and Rivers (previously published as EPA/444/4-89-001). Fish and benthic macroinvertebrate communities, as well as habitat, are characterized.

The FY 1999 Systematic Monitoring Program for the Sulphur River Basin provides a screening-level study of Segment 303 of the Sulphur River Basin. The program includes three stations operated by the USGS, four stations operated by TNRCC, and four stations operated by the SRBA. Table III-3-identifies the monitoring stations, types of measurements, and number of measurements included in the FY 1999 Systematic Monitoring Program.

Specifically, the FY 1999 Systematic Monitoring Program for Segment 303 of the Sulphur River Basin has been designed to achieve the following objectives:

- Collect sufficient data to determine if water quality standards for dissolved oxygen (DO), aluminum, cadmium, lead, and mercury are being exceeded. Lead and mercury were identified as a concern in the 1996 basin assessment report because of the lack of data for these parameters.
- Use biological assessment techniques and sediment analysis, as well as analyses of water samples, to determine if there are significant discharges of metals.
- Determine if aquatic life uses are being impaired.
- Determine if further studies of phosphorus impacts are needed

Table III-3

TABLE III-3
SULPHUR RIVER BASIN
FY 1999 SYSTEMATIC MONITORING PROGRAM

Station Location	Segment	Station ID	Flow	Field	Sampling Parameters & Frequency			
					Conventionals	Metals	Aquatic Life Use	
							Fish & Benthics	Habitat*
N. Sulphur River at SH 24	305	USGS 7343000	C					
		TNRCC 10231		4	4	Wx4 Sx1		
N. Sulphur River at Lamar County Road 16700	305	SRBA 1	2	2		Sx1	2	1
S. Sulphur River at SH 19	303	USGS 7342500	C	4	4	Wx3		
		TNRCC 10222		4	4	Wx4 Sx1		
Sulphur River at Titus County Road 16700	303	USGS 7343200	C	6	6	Wx2 Sx1		
		SRBA 2	2	2		Sx2	2	1
Sulphur River at US 259	303	SRBA 3	2	2		Sx2	2	1
Sulphur River at US Hwy 67	303	TNRCC 10215	4	4		Wx4 Sx1		

White Oak Creek at US Hwy 271	303	USGS 7343500	C	6	6	Wx2		
White Oak Creek NE of Cooper Chapel off Titus County Road NE 35	303	SRBA 4	2	2		Sx2	2	1
White Oak Creek at US 259	303	TNRCC 10198	4	4		Wx4 Sx1		

TARGETED MONITORING

Targeted monitoring programs assist in the permitting process by obtaining data on unclassified streams; characterize the extent and significance of water quality problems; provide data to aid in identifying potential sources of pollutants contributing to confirmed water quality concerns; or address other specific monitoring objectives. During the FY 1998-FY 1999 biennium, two targeted monitoring studies were conducted in the Sulphur River Basin.

A Receiving Water Assessment (RWA) was conducted on Morrison Branch and Little Mustang Creek in August 1998 and August 1999, respectively. The RWA provided data for a determination of the aquatic life uses of Morrison Branch and Little Mustang Creek, the receiving streams for the City of Bogata Wastewater Treatment Plant (WWTP) outfall. Morrison Branch is a small intermittent tributary of Little Mustang Creek, which is a tributary of the Sulphur River (Segment 303). These data will be used by TNRCC to determine the appropriate aquatic life use classification of these streams.

In October 1998 the TNRCC, with assistance from the SRBA, conducted an intensive survey on Rock Creek. Rock Creek is the receiving water for the City of Sulphur Springs WWTP discharge. Rock Creek flows into White Oak Creek, which flows into the Sulphur River, in Segment 303. The intensive survey provided data that can be used when the water quality model for Rock Creek is updated.

SUMMARY OF WATER QUALITY

Five years of water quality data have been examined to characterize water quality in the Sulphur River Basin. Based on this evaluation, recommendations for future actions have been developed.

The data review was conducted as a multi-step process. The initial step was an analysis of the most recent five years of water quality data using a computerized screening program developed by the TNRCC. The program compared the data to criteria that were derived from the stream standards, or based on typical screening levels for parameters without stream standards (nutrients and chlorophyll). A minimum of nine data points for conventional parameters and five data points for metals and organics at a station was required for the parameters to be screened at that station. The screening program calculated the percentage of data points exceeding the screening criteria for each parameter at each station. If more than ten percent of the data exceeded the criteria, further data evaluations were conducted to verify whether a water quality concern exists, to obtain an understanding of the magnitude of the problem, to identify trends in water quality, and, if possible, to identify a source of the pollutants of concern. In

some cases all of these objectives can not be accomplished with the existing data, and further data collection is recommended.

REGIONAL VARIATIONS IN WATER QUALITY

The Sulphur River Basin is a relatively small basin with fairly uniform characteristics throughout. Water quality does not vary significantly across the region.

Areas Of Concern

The results of the screening program are presented on Tables III-4 and III-5. Table III-4 identifies (for each parameter and for each station on a water body) whether individual parameters exceed the screening criteria, do not exceed the screening criteria, or can not be evaluated because of insufficient data. Table III-5 provides the following information for parameters exceeding the screening criteria:

- Number of measurements
- Average value of measurements
- Maximum and minimum values measured
- Screening criteria
- Number of measurements exceeding the screening criteria

Presented below is a discussion of the most significant findings of the water quality data review for major water bodies in the basin. A more detailed discussion of the results of the data evaluations is presented in Chapter IV.

Table III-4

**TABLE III-4
SULPHUR RIVER BASIN
SCREENING PROGRAM RESULTS 1999 BASIN SUMMARY REPORT**

Subwatershed	Segment	Station ID	Conventional Parameters											Metals and Cyanide in Water										
			Temp	pH	DO	Chl a	TP	DP	FC	Cl	SO ₄	TDS	NO ₂ +NO ₃	NH ₃ -N	Ag	Al	As	Cd	Cr	Cu	CN	Mn	Ni	Pb
Wright Patman Lake Subwatershed	301	10212																						
		13783																						
	302	14097																						
		14099																						
		14100																						
		14102																						
		14103																						
14104																								
Sulphur River Subwatershed	303	10215																						
		10199																						
White Oak Creek Subwatershed	303	10198																						
Days Creek Subwatershed	304	10226																						
		15256																						
		15342																						
North Sulphur River Subwatershed	305	10197																						
		10231																						
South Sulphur River Subwatershed	303	10222																						
		306	10234																					
	10238																							
	13632																							
	307	13855																						
		13856																						

	13857																			
	13858																			

Note: Period of data evaluated is approximately 1993-1997. Exact dates vary by station.




Segment	301	Sulphur River below Wright Patman Lake	 Exceeded screening criteria; Requires data evaluation or further study (>10% exceedance)
	302	Wright Patman Lake	
	303	Sulphur /South Sulphur River	
	304	Days Creek	 Did not exceed screening criteria; No further data evaluation or study required (<10% exceedance)
	305	North Sulphur River	
	306	Upper South Sulphur River	
	307	Cooper Lake	 Insufficient data

Table III-5

Wright Patman Lake

Wright Patman Lake is on the 303(d) list of impaired or threatened waters prepared by TNRCC pursuant to Section 303(d) of the Clean Water Act [303(d) list] because of low DO concentrations near the dam and in the headwaters of the reservoir. The further evaluation of the data conducted for this report confirms that occasional low DO concentrations do occur. The low concentrations are more frequent in the headwaters and upper end of the lake. It is recommended that further studies be conducted to determine whether the observed conditions are impacting water uses, whether there are nonpoint sources that have not previously been identified, and/or whether the observed quality is a result of naturally occurring or irreversible conditions.

Sulphur River and South Sulphur River Between Wright Patman Lake and Cooper Lake

Segment 303 of the Sulphur River was placed on the 303(d) list in 1998, and is proposed to be included on the 1999 list, because of low DO concentrations in the lower reach of the segment. However, the data screened for this evaluation do not indicate that there are significant exceedances of the DO criteria. The stream standard for DO is a daily average concentration of 5.0 milligrams per liter (mg/L). From August 1992 until April 1998, the only measurements of less than 5.0 mg/L were two measurements of 4.9 mg/L DO. These two measurements are each below the stream standard by only 0.1 mg/L. If only data for the five-year period 1993-1997 are evaluated, less than 10 percent of the measurements do not meet the criteria. Further, these measurements are instantaneous readings and not 24-hour average values, on which the standards are based. It is recommended that the listing of Segment 303 for DO be deleted.

Segment 303 is included on the 303(d) list for reported exceedances of the acute aluminum (Al) criteria in the lower reach of the segment. However, the water quality standard applies to the dissolved fraction of the Al present in the stream, and none of the dissolved Al measurements in 1993-1997 exceed the criteria. A total Al concentration of 1810 mg/L was measured on February 4, 1998. It is presumed that this measurement was the basis of the 303(d) listing because there is no established method for estimating what fraction of the total Al present is in the dissolved state. However, on February 4, 1998, dissolved Al was also measured and found to be <41 mg/L; so, data conversion is not needed. The dissolved Al measurement documents that there was no exceedance of the Al criteria. Segment 303 should not be listed for Al on the 303(d) list. It is recommended that this listing be deleted.

Segment 303 is also included on the 303(d) list for cadmium (Cd). However, neither the preliminary screening performed by TNRCC for this assessment nor the screening conducted by SRBA for this assessment report identified any measurements of Cd in water that exceed the acute criteria. Therefore, Segment 303 should not be listed for Cd on the 303(d) list. It is recommended that this listing be deleted.

Big Creek Lake

Big Creek Lake is in the Sulphur River watershed. Big Creek Lake is included on the 303(d) list because of the detection of atrazine in the finished drinking water of a water supply system that uses Big Creek Lake as their source of supply. Currently, the drinking water meets all quality requirements for a public water supply. However, there is a concern that atrazine concentrations could increase in the future and impair the water supply. Therefore, TNRCC is recommending that atrazine concentrations in Big Creek Lake be addressed by a TMDL study.

White Oak Creek

Fourteen percent (six of 42 samples) of the DO measurements were below the screening criteria at TNRCC Station 10198 (White Oak Creek at U.S. Highway 259, north of Omaha). Flow data for this station are not available; however, all of the measurements below the screening criteria occurred during the summer months when low-flow conditions are typical.

The screening criteria and presumed DO standard for White Oak Creek is 5.0 mg/L because it is an unclassified perennial water. However, previous studies have determined that some East Texas streams do not maintain a 5.0 mg/L DO concentration under natural conditions during low-flow periods. A study of White Oak Creek should be conducted to determine if a 5.0 mg/L DO standard is appropriate.

AREAS OF IMPROVEMENT

In October 1998 the TNRCC, with assistance from the SRBA, conducted an intensive survey on Rock Creek. Rock Creek is the receiving water for the Sulphur Springs WWTP discharge. The intensive survey data showed that significant improvement in water quality had occurred in Rock Creek when the data were compared to a previous intensive survey conducted in 1979. In the 1979 survey there were several violations of the DO water quality standard; in the 1998 survey, no violations were recorded (Table III-6). Since the earlier survey was conducted, the City of Sulphur Springs has increased the level of treatment provided by the WWTP. The improvement in the quality of Rock Creek is attributed to the improved quality of the discharge of the Sulphur Springs WWTP.

**TABLE III-6
ROCK CREEK
24-HOUR AVERAGE CONCENTRATIONS RECORDED
DURING INTENSIVE SURVEYS**

Station Location	Average DO (mg/L)	
	1979	1998
Rock Creek at IH 30 (km 17)	6.4	7.9
Rock Creek at St. Louis Southwestern Railroad (km 15.8)	4.4	7.1
Rock Creek at Davis farm (km 14.6)	2.5	7.6
Rock Creek at Hall farm (km 14.1)	2.4	6.8
Rock Creek downstream of unnamed pipeline (km 13.0)	2.1	5.9
Rock Creek at FM 69 (km 8.9)	2.8	5.8
Rock Creek 2.6 km downstream of FM 69 (6.5)	4.6	9.5
White Oak Creek 1.3 km downstream of Rock Creek (km 157.2)	5.8	8.0

CHAPTER IV

TECHNICAL SUMMARY

The following chapter provides a detailed review of water quality by subwatershed. The types of analyses employed in the processing of basin water quality data are described. Data within the defined Sulphur River Basin subwatersheds were analyzed to assess water quality concerns and, where appropriate, and feasible, to identify suspected sources or causes of water quality impairment.

DATA EVALUATION PROCESSES

The general processes used to evaluate water quality data include the application of a computerized data screening program developed by the Texas Natural Resource Conservation Commission (TNRCC) and trend analyses. The data evaluation techniques are described below.

The data screening program was developed and initially applied by the TNRCC. To apply the screening program for field and conventional parameters in surface water, at least nine samples are required over the most recent five-year period of record (1993 — 1997). Metals-in-water data were also screened. For metals, at least five samples at a station over the five-year period are required for assessment. If ten percent of the data, for a specific parameter at a station, exceeded the screening criteria value identified by TNRCC, that parameter was designated as requiring further data evaluation.

If the screening program identified a parameter as requiring further data evaluation, trend analysis was one of the evaluations performed. Also, other parameters, which included parameters that did not require further data evaluation, were sometimes evaluated to aid in determining a possible cause of the criteria exceedances. Information about events that have occurred in the basin was also reviewed to help identify possible causes of exceedances. Appendix E contains an inventory of events that may have relevancy to water quality conditions in the basin.

SUBWATERSHED SUMMARIES

The Sulphur River Basin has been divided into six subwatersheds for evaluation. The six subwatersheds are as follows:

- North Sulphur River Subwatershed
- South Sulphur River Subwatershed
- Sulphur River Subwatershed
- Wright Patman Lake Subwatershed
- White Oak Creek Subwatershed
- Days Creek Subwatershed

In the following sections, the water quality of each subwatershed is described. The results of the application of the screening program are described for each subwatershed. Also included are the results of any further data evaluations.

North Sulphur River Subwatershed

The North Sulphur River extends upstream from its confluence with the South Sulphur River in Lamar County. The North Sulphur River is classified as Segment 305 by TNRCC. The segment extends from the confluence of the North Sulphur River with the South Sulphur River to 6.7 kilometers (4.2 miles) upstream of Farm-to-Market (FM) Road 68, in Fannin County. The subwatershed lies in the southeastern corner of Fannin County and the southern half of Lamar County. Drainage to the North Sulphur River is primarily from the north through many small tributary streams. These streams include Auds Creek, Big Sandy Creek, Ghost Creek, and Cane Creek. A map of the North Sulphur River subwatershed, which identifies land use activities and monitoring stations, is presented in Figure IV-1.

There were insufficient data from the station on Auds Creek (Station 10197) to perform screening analyses. The period of record for that station is October 1994 to June 1996.

Figure IV-1

At TNRCC Station 10231/USGS Station 7343000 (North Sulphur River at SH 24, south of Paris) all conventional parameters included in the screening program, were screened. Sufficient metals data were available to screen silver (Ag), arsenic (As), chromium (Cr), copper (Cu), nickel (Ni), lead (Pb), and zinc (Zn). All of the parameters except fecal coliform were compliant with the screening criteria. Four of seventeen fecal coliform measurements exceeded the criterion (Figure IV-2). The period of record at this station is July 1992 through June 1997.

South Sulphur River Subwatershed

The South Sulphur River extends from the confluence with the North Sulphur River upstream to the headwaters of the South Sulphur River in Fannin County. The South Sulphur River subwatershed includes all, or part, of three segments designated by TNRCC. These are the Upper South Sulphur River above Cooper Lake (Segment 306), Cooper Lake (Segment 307), and the South Sulphur River below Cooper Lake (upstream portion of Segment 303). The Middle Sulphur River is a major tributary to Cooper Lake, and a number of smaller streams are lesser tributaries to Cooper Lake and the South Sulphur River. Drainage to the South Sulphur River is primarily from the north. Tributaries in addition to the Middle Sulphur River include Spring, Pecan, Jennings, Doctors, and Big Creeks. A map of the South Sulphur River subwatershed, which identifies land use activities and monitoring stations, is presented in Figure IV-3.

Segment 306 – Upper South Sulphur River

The Upper South Sulphur River, Segment 306, extends from 1 kilometer (0.7 miles) upstream of SH 71 in Delta/Hopkins County upstream to SH 78 in Fannin County. This watershed includes the cities of Commerce and Wolfe City. There are two permitted municipal discharges in this sub-subwatershed.

Historical data from Station 10234 (South Sulphur River at FM 71 east of Commerce) indicate that DO, pH, chlorophyll-*a*, ammonia-nitrogen, and fecal coliform concentrations exceed the screening criteria (Figure IV-4).

Figure IV-2

Figure IV-3

Figure IV-4

Phosphorus data do not exceed the criteria. No significant trends are observed in any of the parameters. The data suggest that, occasionally, algal activity or organic loading may cause DO concentrations less than the stream standard. However, the standard applies to the 24-hour average concentration of DO and not to instantaneous readings, which is the type of data available. It is recommended that diurnal DO data be collected in this segment.

It should also be noted that all of the segments in the Sulphur River Basin except Segment 306 have minimum pH standard of 6.0. If the minimum pH standard for Segment 306 were 6.0, instead of 6.5, there would be one less exceedance of the criteria.

There are insufficient data to screen nitrate-nitrogen, metals, or cyanide (CN) concentrations. The period of record evaluated at station 10234 is July 1992 to June 1997.

At TNRCC Station 10238 (South Sulphur River at SH 11 southeast of Commerce) dissolved phosphorus and pH exceed the screening criteria. Both pH and dissolved phosphorus concentrations appear to be increasing at this station (Figure IV-5). There were no data collected at this station for nitrogen or chlorophyll-*a*. DO concentrations are compliant with the DO criteria. However, high DO concentrations are sometimes measured in the summer that may be indicative of extensive algal activity. Data for Ag, As, cadmium (Cd), Cr, Cu, Ni, Pb, and Zn have been screened, and none of the measurements exceed the screening criteria. There are insufficient data to screen for exceedances of the criteria for aluminum (Al), CN, manganese (Mn), and selenium (Se). The period of record at this station is January 1992 to July 1997.

At Station 13632 (Middle Sulphur River at SH 11, north of Commerce) none of the parameters screened exceed the screening criteria. The results of the screening of the DO and dissolved phosphorus data are presented on Figure IV-6.

Figure IV-5

Figure IV-6

There are insufficient data to screen Al, CN, and Se concentrations. Data were screened for Ag, As, Cd, Cr, Cu, Mn, Ni, Pb, and Zn; none of the measurements exceeded the screening criteria. The period of record for this station is January 1992 to July 1997.

The reach of the South Sulphur River above Cooper Lake is effluent-dominated during low-flow conditions and exhibits signs that significant growth of algae and/or aquatic vegetation may be present. It is recommended that monitoring in this segment continue to determine if algal activity is affecting uses of waters in the segment.

Segment 307 – Cooper Lake.

Cooper Lake, Segment 307, extends from the Cooper Lake Dam in Delta/Hopkins County to a point 1 kilometer (0.7 miles) upstream of SH 71 on the South Sulphur River arm of the lake, and to a point 300 meters (275 yards) below the confluence of Barnett Creek on the Middle Sulphur River arm of the lake. Drainage directly to the lake is mainly from the north. Cooper Lake covers 19,000 acres. There are three permitted municipal discharges in the watershed of Cooper Lake.

The period of record for all stations on Cooper Lake is January 1993 to July 1997. At Station TNRCC 13855/USGS 7342495 (Cooper Lake at USGS Site AC), DO data exceed the screening criteria (Figure IV-7). Three of fifteen measurements in the mixed surface layer exceed the screening criteria for DO. There are insufficient data to screen any other parameters except temperature, pH, phosphorus, chloride, and sulfate. There are no exceedances of the screening criteria for these parameters.

At TNRCC Station 13856 (Cooper Lake at USGS Site BC), three of fifteen DO measurements and three of twenty-four pH measurements in the mixed surface layer exceed the criteria (Figure IV-7). There appears to be a trend of increasing pH levels during the period of record. There are insufficient data to screen for any other parameter at this station except temperature. Temperature measurements do not exceed the screening criteria. This station is located in the arm of the lake that receives inflow from Doctor's Creek. The City of Cooper WWTP is located in the watershed of this creek.

Figure IV-7

At TNRCC Station 13857 none of the parameters screened exceed the screening criteria. Dissolved oxygen, dissolved phosphorus, pH, chloride, sulfate, and temperature were screened.

Two of fifteen measurements of DO in the mixed surface layer at Station 13858 (Cooper Lake at USGS Site DC) exceed the screening criteria (Figure IV-8). There are insufficient data to screen any other parameters except temperature and pH. The temperature and pH measurements do not exceed the screening criteria.

Segment 303 – South Sulphur River

This portion of Segment 303 begins at the confluence of the South Sulphur River with the North Sulphur River on the Delta/Lamar County line and continues upstream to Cooper Dam. Only small communities are located in this watershed, and the land use is primarily cropland. There are no permitted discharges in the watershed for this portion of the river.

Of the parameters screened at Station 10222, (South Sulphur River at SH 19 east of Cooper) none exceed the screening criteria. The parameters screened were temperature, pH, DO, dissolved phosphorus, chloride, sulfate, Ag, Cd, Cr, Cu, Ni, Pb, and Zn. There are insufficient data to screen for nitrogen, total phosphorus, chlorophyll-*a*, Al, As, CN, Mn, and Se.

The quality of the lower South Sulphur River with respect to Cd concentrations requires clarification. Currently, Cd is identified as a concern in this reach of Segment 303 on the 303(d) list. The recent preliminary screening of water quality data by TNRCC did not indicate exceedances of the Cd screening criteria. Similarly, the screening conducted for this report does not identify exceedances of the Cd screening criteria. Data being collected as part of the FY 1999 Systematic Monitoring Program may help clarify whether Cd concentrations are a concern in the reach of the river. If the FY 1999 Systematic Monitoring Program does not provide evidence of concerns attributable to Cd in this reach, Segment 303 should not be listed on the 303 (d) list for Cd.

Figure IV-8

Sulphur River Subwatershed

The subwatershed designated Sulphur River consists of that portion of Segment 303 that extends from 1.5 kilometers (0.9 miles) downstream of Bassett Creek in Bowie/Cass County to the confluence of the North and South Sulphur Rivers in Delta/Lamar County. This subwatershed includes portions of Bowie, Red River, Lamar, Franklin, Titus, Morris, and Cass Counties. It encompasses about twenty-five percent of the land area of the basin. Primary tributaries to the Sulphur River include Bassett, Cuthand, Mustang, and Little Mustang Creeks. White Oak Creek, which is a major tributary to the Sulphur River, has been designated as a separate subwatershed in this report. A map of the Sulphur River subwatershed, which identifies land use activities and monitoring stations, is presented on Figure IV-9.

The FY 1999 Systematic Monitoring Program will provide a screening-level study of Segment 303. Specifically, the study will include the following:

- Collect sufficient data to determine if water quality standards for DO, Al, Cd, Pb, and Hg are being exceeded. Pb and Hg were identified as a concern in the 1996 basin assessment report because of the lack of data for these parameters.
- Use biological assessment techniques and sediment analyses, as well as analyses of water samples, to determine if there are significant discharges of metals
- Determine if aquatic life uses are being impaired.
 - Determine if further studies of phosphorus impacts are needed

In this portion of the Sulphur River, chlorophyll-*a* concentrations periodically exceed the screening criteria. Fifteen percent of the chlorophyll-*a* measurements (three measurements in five years) at Station 10215 (Sulphur River at US 67 northeast of Naples) exceed the screening criteria (Figure IV-10). The period of record for this station is August 1992 to April 1998.

Figure IV-9

Figure IV-10

This segment was placed on the 303(d) list in 1998, and is proposed to be included in the 1999 list, because of low DO in the lower (downstream) reach of the segment. However, the data screened for this evaluation do not indicate there is significant noncompliance with the DO criteria. The stream standard for DO is a daily average concentration of 5.0 mg/L. From August 1992 until April 1998, the only measurements of less than 5.0 mg/L are two instantaneous readings of 4.9 mg/L DO. Both measurements were made before noon when DO concentrations are frequently lower than they are later in the day. If only data for the five-year period 1993-1997 are evaluated, less than 10% of the DO measurements do not meet the criteria. It is recommended that the listing of Segment 303 for DO be deleted.

Segment 303 is listed on the 303(d) list for exceedances of the acute Al criteria in the lower reach of the segment. However, the water quality standard applies to the dissolved fraction of the Al present in the stream, and none of the dissolved Al measurements in 1993-1997 exceed the criteria. A total Al concentration of 1810 mg/L was measured on February 4, 1998. It is presumed that this measurement was the basis of the 303(d) listing because there is no established method for estimating what fraction of the total Al present is in the dissolved state. However, on February 4, 1998, dissolved Al was measured also and found to be <41 mg/L; so, data conversion is not needed. The dissolved Al measurement documents that there was no exceedance of the Al criteria. Segment 303 should not be listed for Al on the 303(d) list. It is recommended that this listing be deleted.

None of the other metals that were screened (Ag, As, Cd, Cu, Ni, Pb, Se, and Zn) exceed the screening criteria. There are insufficient data to screen for Cr, CN, and Mn.

Big Creek Lake is in the Sulphur River subwatershed. Big Creek Lake is included on the 303(d) list because of the detection of atrazine in the finished drinking water of a water supply system that uses this lake as a source of supply. The drinking water currently meets all quality requirements for a public water supply. However, there is a concern that atrazine concentrations could increase in the future and impair the water supply. TNRCC is recommending that atrazine concentrations in Big Creek Lake be addressed by a TMDL Study.

White Oak Creek Subwatershed

This subwatershed is a large tributary stream to the Sulphur River. White Oak Creek extends from its confluence with the Sulphur River in Cass County upstream into Hopkins County. The watershed includes portions of Hopkins, Franklin, Titus and Morris Counties and a very small portion of Cass County. This watershed contains approximately twenty-five percent of the land area in the Sulphur River Basin. White Oak Creek is an unclassified stream segment. A map of the White Oak Creek subwatershed, which identifies land use activities and monitoring stations, is presented on Figure IV-11.

The FY 1999 Systematic Monitoring Program includes one station in the White Oak Creek subwatershed. As part of the SRBA FY 1999 Systematic Monitoring Program for Segment 303 of the Sulphur River, a station will be operated at Titus County Road NE 35 designated in Figure IV-11 as SRBA 4. The purpose of the station is to characterize the quality of inflows from White Oak Creek to the Sulphur River.

The screening program identified DO as requiring further data evaluation in White Oak Creek because fourteen percent (six of 42 samples) of the DO measurements are less than the screening criteria at TNRCC Station 10198 (White Oak Creek at US 259, north of Omaha). The period of record is January 1992 to September 1997. All of the low concentrations occurred during months that can be low-flow months, May through October. Flow data are not available at this station.

The DO water quality standard is presumed to be 5.0 mg/L for White Oak Creek because it is an unclassified perennial water. However, previous studies have determined that some East Texas streams do not maintain a 5.0 mg/L DO concentration under natural conditions during low-flow periods. A study of White Oak Creek should be conducted to determine if a 5.0 mg/L DO standard is appropriate.

Ammonia-nitrogen, nitrite-plus-nitrate, dissolved phosphorus, and pH data for White Oak Creek are compliant with the screening criteria (Figure IV-12). There are insufficient data to screen chlorophyll-*a*.

Figure IV-11

Figure IV-12

The metals that were screened (Ag, As, Cd, Cr, Cu, Ni, Pb, and Zn) do not exceed the screening criteria. Al, CN, Mn, and Se were not screened because of insufficient data.

Wright Patman Lake Subwatershed

This subwatershed includes Segment 301 of the Sulphur River and Wright Patman Lake. Wright Patman Lake is designated as Segment 302 by the TNRCC. The major tributaries in this subwatershed are Anderson Creek, Big Creek, and Elliot Creek. A map of the Wright Patman Lake subwatershed, which identifies land use activities and monitoring stations, is presented on Figure IV-13.

Segment 302 – Wright Patman Lake

Wright Patman Lake extends from the Wright Patman Dam in Bowie/Cass County upstream to 1.5 kilometers (0.9 miles) downstream of Bassett Creek in Bowie/Cass County. The dam impounds the Sulphur River to a normal pool elevation of 225 feet mean sea level (msl). The total drainage area contributing to Wright Patman Lake is approximately 3,443 square miles. The surface area of the lake is 20,300 acres.

The screening program identified DO, pH, dissolved phosphorus and temperature as requiring further data evaluation in Wright Patman Lake. The period of record is January 1993 through July 1997.

At TNRCC Station 14097, DO concentrations in four of fourteen samples are less than the minimum screening criteria (Figure IV-14). All of the low DO concentrations occurred during the warmer months of May through September. Dissolved phosphorus concentrations and pH measurements do not exceed the screening criteria at Station 14097. There are insufficient data to screen chlorophyll-*a* or nitrogen data. Metals were not screened at this station because of insufficient data.

Figure IV-13

Figure IV-14

At TNRCC Station 14100, DO and pH do not meet the screening criteria (Figure IV-14). Three of fourteen DO measurements in the mixed surface layer are less than the minimum screening criteria. Eighteen percent of the pH measurements made in the mixed surface layer exceed the screening criteria. Dissolved phosphorus concentrations do not exceed the screening criteria. There are insufficient data to screen for chlorophyll-*a*, nitrogen, any of the metals, or CN.

At TNRCC Stations 14099 and 14102, there are measured DO concentrations that are less than the minimum screening criteria (Figure IV-15). At both stations, two of fourteen DO measurements in the mixed surfaced layer are less than the criteria. In addition, thirty-one percent of the pH measurements at Station 14099 exceed the screening criteria. Dissolved phosphorus concentrations at Station 14099 do not exceed the screening criteria. There are no dissolved phosphorus data for Station 14102. There are insufficient data to screen for chlorophyll-*a*, nitrogen, or any of the metals at either station.

At TNRCC Station 14104, temperature and DO do not comply with the screening criteria. All of the low DO concentrations occurred during the months of May through August (Figure IV-16). Insufficient data are available to screen for chlorophyll-*a*, nitrogen, metals, or CN.

Wright Patman Lake is on the 303(d) list because of low DO concentrations near the dam and in the headwaters of the reservoir. The further evaluation of the data conducted for this report confirms that occasional low DO concentrations do occur. The low concentrations are more frequent in the headwaters and upper end of the lake. It is recommended that further studies be conducted to determine whether the observed conditions are impacting water uses, the location and significance of point and nonpoint sources, and/or whether the observed quality is a result of naturally occurring or irreversible conditions.

Figure IV-15

Figure IV-16

Segment 301 – Sulphur River below Wright Patman Lake

The Sulphur River below Wright Patman Dam receives flow from Wright Patman Lake and runoff from the surrounding forestland and agricultural areas. Flow is controlled by the releases from the lake. No significant urban runoff is contributed to this section of the river, but the southern outlying area of Texarkana drains to the river. Segment 301 begins at Wright Patman Dam and continues east to the Texas/Arkansas State Line.

At TNRCC Station 10212, chlorophyll-*a* concentrations exceed the screening criteria. DO, pH, phosphorus, and nitrogen were also screened; none of these parameters exceed the screening criteria. The period of record at this station is February 1992 to July 1997. The only metals screened were Ag, As, Cd, Ni, Pb, and Zn; none of these parameters exceed the screening criteria. There are insufficient data to screen for Al, Cr, Cu, CN, Mn, and Se.

At Station 13783, chlorophyll-*a* and ammonia-nitrogen concentrations exceed the screening criteria (Figure IV-17). Chlorophyll-*a* and ammonia-nitrogen concentrations appear to be increasing at this station. DO, pH, nitrate, and dissolved phosphorus measurements do not exceed the screening criteria. There are insufficient data to screen for metals or CN.

Days Creek Subwatershed

Days Creek is in the northeast corner of the Sulphur River Basin. The subwatershed consists of Days Creek and its tributaries. The classified portion of Days Creek, designated Segment 304 by TNRCC, starts at the Texas/Arkansas border and continues upstream to the confluence of Nix and Swampoodle Creeks. Tributaries to Days Creek include Cowhorn, Howard, Nix, Rocky, Swampoodle and Waggoner Creeks. Nix and Rocky Creeks are primarily in Arkansas. A map of the

Days Creek subwatershed, which identifies land use activities and monitoring stations, is presented on Figure IV-18.

Figure IV-17

Figure IV-18

The screening program identified ammonia-nitrogen as requiring further data evaluation at three stations in this segment. However, two of these stations (15256 and 15342) were only sampled during runoff events. The data were collected as part of a stormwater runoff study conducted by the SRBA with funding from the CRP. Data collected during this study are presented in Figure IV-19. Stormwater runoff conditions are typically short-term events, and elevated ammonia concentrations are not unusual during these conditions. Therefore, data from these two stations may not be representative of the quality of Days Creek.

At TNRCC Station 10226 the period of record is from May 1992 to June 1997. Eighteen percent of the ammonia-nitrogen and twenty-five percent of the fecal coliform measurements at Station 10226 exceed the screening criteria (Figure IV-20). Dissolved phosphorus and DO concentrations do not exceed the screening criteria. Insufficient data are available to screen for nitrate, metals, or CN.

Figure IV-19

Figure IV-20

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are based upon the analyses and evaluations conducted to develop the summary report. Recommendations were also provided by the Sulphur River Basin Steering Committee and with other entities.

The Preliminary Basin Action Plan presented in this chapter identifies water quality conditions that warrant further investigation or corrective action and potential sources of the pollutants that are adversely impacting water quality, to the extent known. In FY2000 a recommended action plan will be developed for addressing the concerns identified in the Preliminary Basin Action Plan.

PRELIMINARY BASIN ACTION PLAN

The Preliminary Basin Action Plan was compiled upon the completion of the assessment of water quality in the basin. This information is presented in a table that outlines the water identified as significant concerns by the assessment and the activities that have occurred previously, or are underway, to address these concerns. At the completion of the strategy development phase in FY 2000, the final Basin Action Plan will be completed. The Basin Action Plan will include information on impaired water uses, causes, pollutant sources, actions taken to date, and recommended actions. The Preliminary Basin Action Plan for the Sulphur River Basin is provided in Table V-1.

CONCLUSIONS

Through the Clean River Program (CRP), the Sulphur River Basin has benefited in a number of ways:

- Local concerns or problems are being addressed;
- Some basin dischargers have been assisted with their permits; and

Table V-1

**TABLE V-1
PRELEMINARY BASIN ACTION PLAN
SULPHUR RIVER BASIN**

Segment Number	Water Body	Impaired Use	Cause	Source	Action Taken	Recommended Action	Rank	Funding Source	Active Participants
302	Wright Patman Lake	Aquatic Life Use ⁽¹⁾	Low Dissolved Oxygen	Wastewater Treatment Plants ⁽¹⁾ Agricultural Runoff ⁽¹⁾ Septic Systems ⁽¹⁾ Natural Conditions ⁽¹⁾	On 303(d) list; FY 2000 systematic monitoring schedule to investigate tributary inflows; More intensive monitoring of diurnal DO and nutrients proposed in FY 2000; Investigation of pattern of taste and odor problems in water supplies proposed				
303	Sulphur River	Aquatic Life Use ⁽¹⁾	Aluminum Dissolved Oxygen	Unknown	On 303(d) list; FY 1999 Systematic Monitoring Program conducted; Historical data review demonstrated 303(d) listing not appropriate				
303	South Sulphur River	Aquatic Life Use ⁽¹⁾	Cadmium	Unknown	On 303(d) list; FY 1999 Systematic Monitoring Program conducted; Historical data review demonstrated 303(d) listing not appropriate				

Segment Number	Water Body	Impaired Use	Cause	Source	Action Taken	Recommended Action	Rank	Funding Source	Active Participants
303	Big Creek Lake	Threatened Public Water Supply ⁽¹⁾	Atrazine	Agricultural Runoff ⁽¹⁾	On 303(d) List; TNRCC conducting TMDL study supported by City of Cooper				

⁽¹⁾ Not yet confirmed

A basin database, which is continually updated and made accessible to the public, has been developed.

In addition, monitoring coordination is increasing in the Sulphur River Basin. In 1999, the Sulphur River Basin Authority (SRBA) hosted a meeting of all of the entities in the basin that conduct monitoring in conformance with the quality assurance objectives of the CRP. It is proposed to have similar meetings on an annual basis in the future. This increased coordination ensures better monitoring coverage of the Sulphur River Basin, helps avoid duplication of effort among agencies, and allows the monitoring partners to share their experiences and, in some cases, equipment in the basin.

As a result of an in-depth evaluation of the water quality data collected during the five-year period of 1993-1997, the following conclusions have been reached regarding water quality conditions in the Sulphur River Basin:

- Overall, the quality of waters in the basin is good.
- In the Sulphur River below Wright Patman Lake (Segment 301), instream concentrations of chlorophyll-a and ammonia appear to be increasing. The cause of this apparent increase has not yet been determined.
- In Wright Patman Lake (Segment 302), occasional low dissolved oxygen (DO) concentrations occur. Segment 302 is currently on the list of impaired or threatened waters prepared by the Texas Natural Resource Conservation Commission (TNRCC) pursuant to Section 303(d) of the Clean Water Act [303(d) list] for DO. The low concentrations are more frequent in the headwaters and upper end of the lake. Further studies are needed to determine whether the observed conditions are impacting water uses, the location and significance of point and nonpoint sources, and/or whether the observed quality is a result of naturally occurring or irreversible conditions. In FY 2000 more intensive sampling of the lake and major tributaries is proposed.
- The Sulphur River above Wright Patman Lake (Segment 303) is on the 303(d) list for DO and aluminum. The review of historical data conducted for this report indicates that this reach of the Sulphur River should be removed from the 303(d) list. Additional data were collected in fiscal year (FY) 1999 to investigate further whether or not the listings are appropriate. When the FY 1999 data are available, recommendations regarding the listings will be submitted to TNRCC.
- The South Sulphur River below Cooper Lake (Segment 303) is on the 303(d) list for cadmium. The review of historical data conducted for this report indicates that this reach of the South Sulphur River

should be removed from the 303(d) list. Additional data were collected in FY 1999 to investigate further whether or not the listing is appropriate. When the FY 1999 are available, a recommendation regarding the listing will be submitted to TNRCC.

- Big Creek Lake (Segment 303) is on the 303(d) list for atrazine. The TNRCC is currently conducting a statewide Total Maximum Daily Load (TMDL) study investigating the occurrence of atrazine in water supplies. Big Creek Lake is included in this TMDL study.
- White Oak Creek (Segment 303) exhibits occasional DO concentrations that are less than the presumed water quality standard of 5.0 mg/L. Studies of other East Texas streams have determined that, during low-flow periods, some East Texas streams do not maintain a 5.0 mg/L DO concentration due to natural conditions. It has been recommended that a study of White Oak Creek be conducted to determine if 5.0 mg/L is an appropriate DO standard for this stream.
- Intensive surveys were conducted of Rock Creek (Segment 303) in 1979 and 1998. During the 1979 survey, several DO measurements below the water quality standard were recorded. In 1998 all DO measurements were compliant with the water quality standard. The improvement in the quality of Rock Creek is attributed to the improved quality of the discharge of the City of Sulphur Springs wastewater treatment plant.
- The upper South Sulphur River (Segment 306) appears to contain significant algal growth. A study is recommended to determine whether the algal growth is impacting water uses.
- Cooper Lake (Segment 307) exhibits occasional low DO concentrations and appears to contain significant algal growth. A study is recommended to determine whether these conditions are impacting water uses.

BASIN RECOMMENDATIONS

The following recommendations for the Sulphur River Basin are based on the findings reported in this assessment, data collected by the SRBA, and recommendation provided by other entities. Recommendations were also provided by the Sulphur River Basin Steering Committee.

Monitoring Recommendations

Based on the conclusions of the evaluation of historical water quality data, recommendations for monitoring specific waters have been made. These are summarized in Table V-2. In addition, the following recommendations related to the monitoring program have been made to the SRBA:

- Provide better data on the locations of dairies in the basin.
- Provide data for parameters that currently cannot be screened because of insufficient data.
- Investigate funding sources to support expanded monitoring activities in the basin.
- Enhance the coordination of monitoring programs in the Sulphur River Basin, and determine the interest of local entities in participating in the CRP monitoring program.
- Continue to provide opportunities for public involvement.

Table V-2

**TABLE V-2
RECOMMENDATIONS
SULPHUR RIVER BASIN – 1999**

Subwatershed	Segment <i>NUMBER</i>	Parameters Requiring Further Study	<i>RECOMMENDATIONS</i>
N. Sulphur River Subwatershed	305	Fecal Coliform	Does not appear to be a concern at this time. Re-evaluate after TNRCC completes statewide

					fecal coliform study and revises water quality standards.
S. Sulphur River Subwatershed		306	Chlorophyll <i>a</i> DO Nutrients PH Fecal Coliform		Diurnal DO data are needed to determine if low concentrations are related to algal activity, and information is needed on whether uses are being impaired. Fecal Coliform does not appear to be a concern at this time. Re-evaluate after TNRCC completes statewide fecal coliform study and revises water quality standards.
		307	DO PH		Depressed DO levels may be a concern. Additional data is needed to determine whether uses are being impaired.
		303 (part)	Cadmium		Historical data do not support the listing. If FY 1999 data support this conclusion, submit recommendation to TNRCC to de-list cadmium in Segment 303.
Sulphur River Subwatershed		303 (part)	Chlorophyll <i>a</i> DO Aluminum		Review FY 1999 data, when available, to determine if algal activity appears to be impacting uses. Historical data do not support the listing. If FY 1999 data support this conclusion, submit recommendations to TNRCC to de-list DO and/or aluminum in Segment 303.
Wright Patman Subwatershed	Lake	302	DO pH Temperature		Additional data collection efforts are planned in FY 2000 to determine the significance and source of noncompliances with these criteria.
		301	Chlorophyll <i>a</i> Ammonia-nitrogen		Does not appear to be a water quality concern. However, future evaluations should confirm this and determine the cause of apparent increases in concentrations of these parameters.
Days Creek Subwatershed		304	Ammonia-nitrogen Fecal Coliform		Do not appear to be a water quality concern. Re-evaluate after TNRCC completes statewide fecal coliform study and revises water quality standards.
White Oak Creek Subwatershed		303 (part)	DO		Determine if 5.0 mg/L is appropriate water quality standard.

Big Creek Lake

303 (part) Atrazine

Participate in TNRCC statewide TMDL study.

- Provide an appendix to the report that presents the results of the analyses of duplicates and blanks for all laboratory testing, including TNRCC testing.
- Contribute to the development of balanced, scientifically-based management programs for waters not supporting designated uses by providing technical data and opportunities for public involvement in the process to develop the programs.

Programmatic Recommendations

The streamlined number of tasks for the Clean Rivers Program has made tracking program activities and deliverables much easier. The increased coordination occurring because of the CRP has been very beneficial to the Sulphur River Basin. It has resulted in increased sharing of knowledge among entities and provided the ability to share this information with the public. Increased resources for the Sulphur River Basin would provide the SRBA with the ability to address more water quality concerns or assist basin permittees more frequently.

Programmatic recommendations from the Sulphur River Basin Steering Committee and participants in the Sulphur River Basin CRP include the following:

- Ensure a broad representation and a direct decision-making role for the stakeholders within each basin.
- Ensure CRP money is used to address significant problems; i.e., address problems that have been verified and do not use assumed water quality conditions.

Regulatory and Legislative Recommendations

A considerable effort has been put forth by the river authorities and the TNRCC watershed assessment staff to develop the CRP into a viable program that provides an on-going assessment of water quality. Great strides have been made toward implementing cooperative efforts between CRP partners, agencies, dischargers, and the public to provide a program that monitors, evaluates, educates, and develops solutions for water quality issues in the basin. The CRP is especially beneficial for smaller river authorities that do not have the means to support a water quality program.

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APPENDIX B

SULPHUR RIVER BASIN - CLEAN RIVERS PROGRAM

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<i>AGENCY</i>	<i>Field Parameters</i>	<i>Conventional Parameters</i>	<i>Metals in Water</i>	<i>Metals in Sediment</i>
USGS	Conductivity DO PH Temperature Turbidity	Alkalinity Ammonia-Nitrogen BOD Calcium Chloride Flouride Magnesium Nitrite+Nitrate Organic Nitrogen Ortho Phosphate Phosphorus, dissolved Potassium Silica Sodium Sulfate TDS TOC Volatile Solids	Arsenic Barium Beryllium Cadmium Chromium Cobalt Copper Iron Lead Lithium Manganese Mercury Molybdenum Nickel Selenium Silver Strontium Vanadium Zinc	Aluminum Barium Cadmium Chromium Cobalt Copper Iron Lead Manganese Mercury Nickel Silver Zinc
TNRCC	Conductivity DO pH Temperature	Alkalinity Ammonia-Nitrogen, Chloride Chlorophyll <i>a</i> Nitrite + Nitrate Pheophytin- <i>a</i> Ortho-phosphate Sulfate TDS TKN TOC TP VSS	Aluminum, dissolved Arsenic, dissolved Cadmium, dissolved Chromium, dissolved Copper, dissolved Hardness, dissolved Lead, dissolved Mercury, total Nickel, dissolved Selenium, total Silver dissolved Zinc, dissolved	Aluminum Arsenic Barium Cadmium Chromium Copper Lead Manganese Mercury Nickel Selenium Silver Zinc
SRBA	Conductivity DO, diurnal pH Temperature		Aluminum, dissolved Arsenic, dissolved Cadmium, dissolved Chromium, dissolved Copper, dissolved Lead, dissolved Mercury, total Nickel, dissolved Selenium, dissolved Silver, dissolved Zinc, dissolved	Aluminum Barium Cadmium Chromium Cobalt Copper Iron Lead Manganese Mercury Nickel Silver Zinc

APPENDIX D

**Population Predictions
Sulphur River Basin**

Segment	County/City(1)	1990²	2000	2010	2020
301	Bowie County				
	Nash (50)	1,081	1,518	1,690	1,880
	Wake Village	4,757	5,771	6,424	7,152
	Other (10)	3,232	3,079	3,445	4,177
	Cass County				
	Queen City (40)	691	816	864	919
	Other (10)	1,781	1,907	2,081	2,375
Total		11,542	13,091	14,504	16,503
302					
	DeKalb (50)	988	1,173	1,305	1,453
	Maud	1,049	1,338	1,490	1,660
	New Boston	5,057	6,347	7,066	7,866
	Other (33)	10,765	10,254	11,473	13,910
	Cass County				
	Other (20)	3,563	3,815	4,161	4,750
	DeKalb County				
	Other (5)	429	464	506	579
Total		21,850	23,391	26,001	30,218
303	Bowie County				
	Other (20)	6,465	6,159	6,890	8,354
	Cass County				
	Other (10)	1,781	1,907	2,081	2,375
	Delta County				
	Cooper (50)	1,077	1,446	1,723	1,982
	Other (50)	1,352	1,437	1,715	1,987

Segment	County/City(1)	1990²	2000	2010	2020
Franklin County					
	Mount Vernon	2,219	2,998	3,543	4,083
	Other (67)	3,271	3,476	4,150	4,807
Hopkins County					
	Sulphur Springs	14,062	17,307	19,269	21,452
	Other (33)	4,919	5,877	6,472	7,648
Lamar County					
	Other (5)	801	1,044	1,161	1,379
Morris County					
	Other (33)	2,499	2,977	3,501	4,051
Red River County					
	Bogata	1,421	1,612	1,755	2,008
	Clarksville	4,311	4,869	5,304	6,071
	Other (5)	4,293	4,640	5,055	5,788
Titus County					
	Other (67)	7,804	8,149	9,183	11,353
Total		56,275	63,898	71,802	83,338
304					
	Nash (50)	1,081	1,519	1,690	1,881
	Texarkana (50)	15,828	19,019	21,176	23,577
	Other (5)	1,616	1,540	1,723	2,089
Total		18,525	22,078	24,589	27,547
305					
	Other (5)	135	144	172	199
Fannin County					
	Honey Grove (25)	420	490	507	652
	Other (13)	1,837	1,949	2,269	2,597

Segment	County/City(1)	1990²	2000	2010	2020
Lamar County					
	Paris (50)	12,350	14,356	16,268	18,434
	Reno (50)	892	670	759	860
	Other (50)	8,013	10,440	11,608	13,790
Hopkins County					
	Other (5)	739	882	972	1,148
Total		24,386	28,931	32,555	37,680
306	Fannin County				
	Other (7)	989	1,049	1,222	1,398
Hopkins County					
	Other (10)	1,477	4,412	4,859	5,742
Hunt County					
	Commerce (70)	4,778	5,690	6,437	7,151
	Wolfe City	1,505	1,884	2,131	2,367
	Other (20)	6,158	7,433	7,992	8,475
Total		14,907	17,821	18,754	21,688
307	<i>DELTA COUNTY</i>				
	Cooper (50)	1,076	1,446	1,723	1,982
	Other (45)	1,217	1,293	1,543	1,788
Fannin County					
	Other (6)	848	900	1,049	1,199
<i>HOPKINS COUNTY</i>					
	Other (15)	2,216	2,647	3,887	3,445

Segment	County/City(1)	1990²	2000	2010	2020
<i>HUNT COUNTY</i>					
	Commerce (30)	2,047	2,439	2,759	3,064
	Other (13)	4,003	4,832	5,194	5,509
Total		11,407	13,557	16,155	16,987

APPENDIX E
EVENTS INVENTORY
SULPHUR RIVER BASIN

Segment	Event	Date	Participants/Location
Lower Sulphur River Segment 301	On TNRCC Wastewater Case List - City of Bloomburg, 11146-001	November 30, 1998	TNRCC
Wright Patman Lake Segment 302	Low DO in lake may be due to natural causes/lake hydraulics	August 1996	SRBA, Texarkana Water Utilities, ATCOG, TNRCC
	On TNRCC Wastewater Case List - City of Avery, 10733-002	November 30, 1998	TNRCC
Sulphur/South Sulphur River, Segment 303	City of Sulphur Springs upgraded WWTP in operation	1998	City of Sulphur Springs
	Flooding in east Hopkins County due to tributaries to White Oak Creek (303 priority)	July 1997	SRBA, Basin Steering Committee
	Citizen group monitors along 303 near SH67- would also like to monitor White Oak	July 1997	SRBA, Basin Steering Committee, volunteer monitors
	Low DO/sluggish flow reported for mainstem with backwater up tributaries	June 11, 1998	City of Talco; City of Bogata; City of Deport
	RWA at Bogata (Morrison Creek)	August 21, 1998	SRBA, Bogata
	No rainfall for previous 75 days	August 21, 1998	SRBA
	On TNRCC Wastewater Case List - City of Annona, 10863-001	November 30, 1998	TNRCC

Segment	Event	Date	Participants/Location
Sulphur/South Sulphur River, Segment 303 (Continued)	On TNRCC Wastewater Case List - City of Clarksville, 10148-001	November 30, 1998	TNRCC
	On TNRCC Wastewater Case List - City of Detroit, 10724-001	November 30, 1998	TNRCC
	On TNRCC Wastewater Case List - City of Sulphur Springs, 10372-001	November 30, 1998	TNRCC
Days Creek Segment 304	Intensive Survey - Sulphur Springs WWTP (Rock Creek)	October 27-29, 1998	SRBA, TNRCC
	Record Rainfall- 10 inches in Texarkana, Texas	May 28, 1998	SRBA Board of Directors
North Sulphur River Segment 305	On TNRCC Wastewater Case List - City of Ladonia, 10740-001	November 30, 1998	TNRCC
Cooper Lake Segment 307	Impoundment of Cooper Lake commenced	September 28, 1991	U.S. Army Corps of Engineers