Red River Authority of Texas
May 2002

Red River Basin Highlights Report

Introduction: For more than a decade the Red River basin reaches have not received their normal annual rainfall amounts, causing an ever increasing deficit. Most, if not all, of the reservoirs are well below capacity due to the lack of rainfall and high evaporation rates caused by very high temperatures and low humidity. Average annual rainfall amounts range from 15 to 55 inches from west to east.

The second longest river in the state encompasses 43 counties of North Texas, known as the Red River Valley. Originating in eastern New Mexico, the Red River flows across the Panhandle carving the spectacular Palo Duro Canyon of the High Plains. It then leaves the Caprock Escarpment flowing eastward to become the Texas-Oklahoma boundary, then continues its course across Texas into southwest Arkansas to Louisiana and the Mississippi River, covering a drainage area of 94,450 square miles and 1,616 stream miles. Six major ecoregions and contrasting elevations from 4,835 feet to 495 feet shape this diverse area. The basin contains the largest capacity reservoir in Texas, Lake Texoma, plus 31 other major reservoirs that provide water to a population of approximately 925,000. Please refer to the Vicinity Map located on page 4.

Red River at Burkburnett

Water Quality Issues: The sheer size and diversity of the Red River justify numerous issues. However, ongoing drought and highly saline water continue to be the two onerous conditions that plague the Red. The two issues complement one another, yet compete for their own special attention. Conservation practices are a way of life for the people in this unique region. While farmers and ranchers in the western area have consistently conserved this precious resource, the eastern reaches of the Red have recently been drought-stricken, and are now adapting to a new way of life. Red River Authority of Texas has worked diligently with the U.S. Army Corps of Engineers (USCOE) since 1959 to resolve the salinity issues through the implementation of the Chloride Control Project, however, the implementation of the project has been delayed due to state and federal agency concerns over the environmental impact of diverting the water. For over a decade millions of dollars appropriated by the federal government to complete the Chloride Control Project have been diverted to numerous studies concerning possible impacts of reducing naturally occurring chlorides and its effect on the environment. As State Sponsor of the project, the Authority will persevere to its successful completion.

The Assessment Process: The Texas Natural Resource Conservation Commission (TNRCC) assesses the state's water bodies periodically under the Clean Water Act Section 305(b). The resulting listing, or Water Quality Inventory, comprises all *Concerns* and *Impairments* within the state. The Clean Water Act (CWA) requires the inventory to be updated biennially utilizing the preceding five years of data. The 2002 Water Quality Inventory provides an assessment of the water quality samples collected between March 1, 1996 through February 28, 2001.

An *Impairment* is assigned to a portion of a water body when certain water quality constituents reach specific concentrations in excess of the Texas Surface Water Quality Standards (TSWQS) during a five-year period. This designation indicates that the uses of the water body, such as drinking, recreation, fishing, or aquatic life, are not supported. Streams that indicate an impairment for one or more constituents are included in the TNRCC's CWA 303(d) list, which is a compilation of the state's impaired water bodies.

The inclusion of a water body on this list triggers a series of possible actions by the TNRCC, which may include denial of increases in wastewater permit effluent limits, a Total Maximum Daily Load (TMDL) project to allocate pollutant loads to certain sources, or the institution of a strategy for reducing loads from all sources.

Concerns are assigned by TNRCC to portions of water bodies under less rigorous requirements for frequency and concentration of the constituent. This designation is usually attributable to a small amount of available data or an unsubstantial number of samples not meeting the TSWQS. Without adequate evidence to be listed as an *Impaired* water body, it is designated as a *Concern*, thereby requiring more information.

Clean Water Act
303(d) – List of Impaired Water Bodies – 2000
305(b) – Water Quality Inventory Report – 2002

Water quality *Concerns* are also identified for constituents, such as nutrients, that are not linked to the TSWQS. Water bodies with water quality concerns are identified in the 305(b) Report, but not included on the 303(d) List of Impaired Water Bodies.

Field Observations with Mobile Lab

Overview of Water Qualify Monitoring: To expedite planning, monitoring, geographical analysis, and dissemination of data, the Red River Basin is divided into five sub-basins or reaches, then further divided into subwatersheds. Definitive procedures have been implemented to assess the basin comprehensively for the ultimate goal to conserve, reclaim, and protect the water resources of the Red River Basin.

Selected water quality monitoring sites have been designated for collection of chemical, physical, and biological data, coordinated with other entities, including the TNRCC and the U.S. Geological Survey (USGS), to produce the Coordinated Monitoring Schedule, thereby virtually eliminating duplication of effort. Refer to **Table 1** on page 14 for details of the monitoring sites, sampling constituents, and frequency.

Collected samples are analyzed in the field, at the Authority's Environmental Laboratory, or sent to a contract laboratory. Within days of collection, the

results of the analyses are entered into the data repository, which contains more than ten years of quality-assured water resource information of the basin. The data, obtained from 58 monitoring stations, are then screened and quality assured utilizing methodologies and criteria approved by the TNRCC with respect to surface water quality standards. Data entered into the database are immediately available for use by the public via the Authority's website at www.rra.dst.tx.us/CRP, and to assist local communities who are facing stricter permitting requirements to make informed decisions about their water resource management practices, based on good science.

With respect to stream standards, the condition of the water resources within the basin is generally good and supports aquatic life and uses. However, only 12 of the 30 classified stream segments have been designated for public water supply use because of naturally high concentrations of salt. The main constituents of the Pease River, Prairie Dog Town Fork of the Red River, and the Wichita River contain high levels of dissolved solids, which are caused by elevated levels of chlorides and sulfates. These highly saline rivers contribute more than 65% of the dissolved solids load into the main stem of the Red River. Salinity in these streams during low-flow periods matches or exceeds the salinity of sea water.

Red River Below Denison Dam

Water Quality Data Review: **Reach I** encompasses an area approximately 230 miles long by 35 miles wide, beginning at Texarkana in Bowie County and ending upstream just inside Clay County. The diversity of Reach I is characterized as rural with several small communities in the easternmost part to the area of Sherman/Denison that is considered to be one of the fastest growing areas in the state. Other major cities include Texarkana, Paris, Gainesville, Bonham, Bowie, New Boston, and Clarksville. There are more than 75 towns with populations less than 10,000. The population of Reach I is approximately 350,000. Major reservoirs include: Pat Mayse Lake, Lake Bonham, Lake Texoma, Amon G. Carter Lake, Moss Lake, and Lake Nocona. Refer to the vicinity map of the Red River Basin on the following page, as well as the individual maps at the end of the report delineating factors influencing water quality in each reach and the CWA 305(b) inventory of water quality concerns.

The five subwatersheds in this reach total 7,698 square miles of contributing drainage to the Red. Reach I contains three classified stream segments (0201, 0202, and 0204) and five classified water bodies (0203, 0208, 0209, 0210, and 0225). There are 53 permitted municipal and industrial dischargers, 15 permitted solid waste disposal sites, 1,595 petroleum storage tanks, and three concentrated animal feeding operations (CAFOs). The Authority conducted 40 monitoring events collecting 926 parameters utilizing 20 water quality monitoring stations (10 routine and 10 systematic) during this past year. The analysis of monitoring data indicated that pathogens (E. coli and fecal coliform) were the only parameters that exceeded stream standards in Reach I.

Nutrients and dissolved solids have increased slightly due to the drought. Four segments (0201A, 0202D, 0202E, and 0203A) have exhibited concerns for elevated bacterial concentrations. Refer to **Table 2**, ***Review of Concerns and Impairments***, for more information. The concentrations of these pathogens tend to peak during runoff after rainfall events. This is indicative of stormwater runoff from agricultural areas and probably the primary cause for the elevated

RED RIVER BASIN

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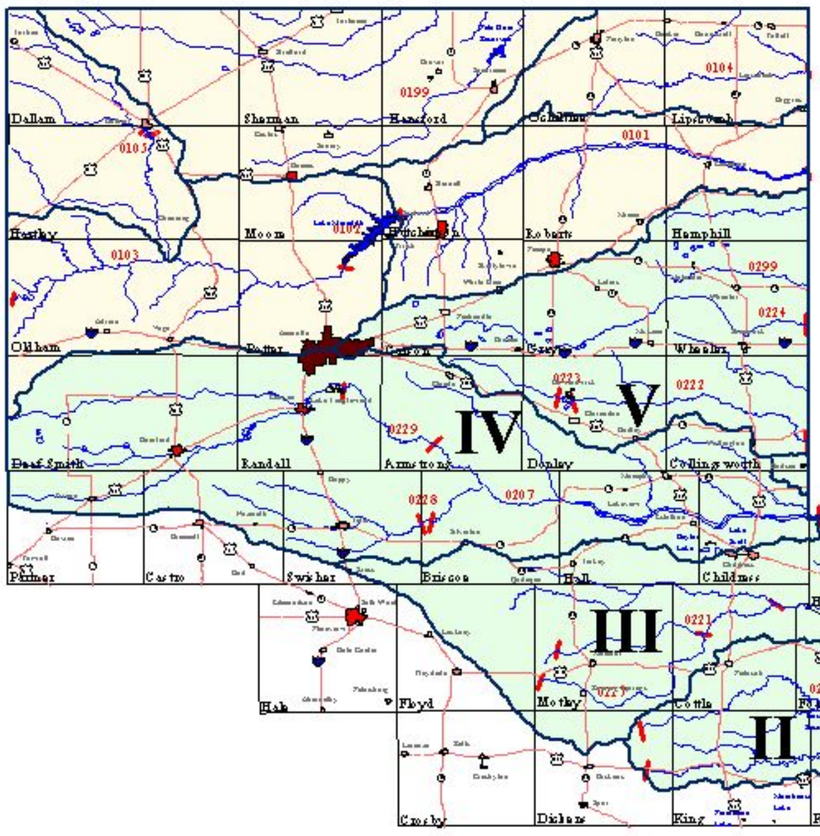

Reach Boundaries

Population

- 0 - 2826
- 2827 - 10875
- 10876 - 34395
- 34396 - 101986
- 101987 - 172289

Highways

Canadian River Basin Hydrology

Red River Basin Hydrology

Counties

Canadian River Basin Segments

Red River Basin Segments

Reservoirs

Canadian River Basin

Red River Basin

50 0 50 100 Miles

Vicinity Map

parameters. Further investigations and supplemental sampling in Pine Creek (0202D) revealed that the bacterial load is more likely to be originating from Smith Creek, a tributary which drains the northwest section of the City of Paris' industrial district. In addition, Pine Creek below Lake Crook to its confluence with the Red River has experienced nutrient enrichment concerns for ammonia and orthophosphorous. Although not included in the data review for the 305(b) report due to a limited amount of data, Smith Creek, located upstream from Pine Creek, has experienced extreme levels of bacteria, which logically affects Pine Creek. A special study to locate the source of the elevated fecal concentrations and the development of a corrective action plan are scheduled in the near future.

Pat Mayse Lake, a public water supply source in Segment 0209, has experienced elevated pH levels. Because of limited exceedance data, it is assumed that this may be the result of equipment malfunctions, since other samples were in the normal range for this water body.

Lake Texoma (Segment 0203) has high concentrations of chlorides, sulfates, and total dissolved solids (TDS). Lake Texoma serves myriad purposes, but foremost, it is a drinking water supply. As stated earlier, the Authority has worked diligently during the past 45 years to get the Chloride Control Project (CCP) in full operation, which would significantly reduce the excessively high chlorides in Lake Texoma. Full support for the completion of the CCP could effectively reduce this problem to an acceptable level.

Big Mineral Creek (Segment 0203A) has experiences of excessive bacterial concentrations. It receives inflows from urban areas and other tributaries. Although utilized by local ranchers, access is limited to the watershed due to its location, which is upstream of the Hagerman Wildlife Refuge.

The Red River above Lake Texoma (Segment 0204) was listed on the 2000 303(d) List of Impaired Water Bodies for bacteria. However, it will not be included on the 2002 303(d) list since it is now supporting the CWA standards. In addition, the recent screening for the 305(b) report indicates excessive algal growth. Inflows from several sources including a sand mining facility, local agricultural activities, and municipal wastewater discharges contribute to the high nutrient loading in this reach.

Mud Creek (Segment 0201A) has a water quality concern for bacteria. During prolonged periods of heat and drought, it becomes intermittent with perennial pools in sections that normally flow. It is frequented by livestock and in the past, beaver activity has caused slight stagnation in some areas due to low or no flow conditions.

Although only a limited amount of data was available for screening, Post Oak Creek (Segment 0202E) displayed elevated bacterial levels. It is a perennial creek that runs through the City of Sherman, which makes it highly susceptible to urban runoff during rainfall events.

Analyzing Samples at RRA Lab

Basin **Reach II** represents the Wichita River and Little Wichita River watersheds from the confluence with the Red to their headwaters, which begin in Clay County and continue westward to Dickens County. The area is approximately 170 miles in length and 50 miles wide. Wichita Falls is the largest city in this reach with a population of 104,197. Iowa Park, Olney, Henrietta, Electra, Seymour, Archer City, and Holliday lead the list of approximately 50 towns below 10,000 population.

Although the western portion of Reach II contains a few small towns, it is the location of some of the largest ranches in Texas, including the W.T. Waggoner Estate, Ed Lowrance Ranch, and the Four Sixes Ranch. Oil and gas production and several industries are located in this area. The population of Region II is about 180,000. Significant reservoirs in the region include Lake Arrowhead, Lake Kickapoo, Lake Kemp, and Lake Diversion.

Five subwatersheds, ten classified stream segments (0211, 0212, 0213, 0214, 0215, 0216, 0217, 0218, 0219, and 0226), and 4,951 square miles of contributing drainage are contained within Reach II. There are 38 permitted municipal and industrial dischargers, 25 permitted solid waste disposal sites, 2,137 petroleum storage tanks, and 15 CAFOs. Forty-nine monitoring events were conducted and 1,514 parameters evaluated in the 30 water quality monitoring stations (20 routine and 10 systematic) during the past year in Reach II.

Yet again drought conditions played a major role in water quality concerns in Reach II. Wichita Falls, which is the major water provider in the area, is utilizing the highly saline water from Lake Kemp to blend with good quality water from Lakes Arrowhead and Kickapoo to assure adequate water is available to meet the ever increasing needs for potable water. The city is currently constructing an advanced treatment process facility to reduce the chloride levels in water from Lakes Kemp and Diversion. Vernon, Seymour, and Electra are utilizing similar techniques, as well as other sophisticated demineralization processes to reduce high nitrate levels in ground water. Completion of the Chloride Control Project would significantly lower the TDS in several water bodies in this area, thereby reducing the high cost of the expensive treatment facilities, and provide additional potable water sources for Reach II.

Seven segments in Reach II were included in the CWA 305(b) report (0211, 0214, 0214A, 0216, 0218, 0218A, and 0226) as having water quality *concerns* or *impairments*. Segment 0211, which is the Little Wichita River from Lake Arrowhead to the confluence of the Wichita River, was identified as having excessive algal growth, TDS, and depressed DO. The East Fork of the Little Wichita River (Segment 0211) exhibited elevated TDS, which may be attributed to oil field intrusions. Excessive algal growth on the main stem of the river was probably due to stormwater runoff combined with dry conditions that kept animals near the water supplies. Concerns listed for the portion of the segment from Lake Arrowhead to Henrietta are due to intermittently regulated release of water from Lake Arrowhead downstream via the Little Wichita River.

Parameters of concern on the Wichita River below the Lake Diversion dam (0214) include orthophosphorous, ammonia, excessive algal growth, nickel in sediment, and total phosphorus, most likely the result of a wastewater treatment plant located about half way within the segment.

The relatively shallow, highly turbid Beaver Creek (0214A) has been identified as having depressed DO. The eutrophic nature of Beaver Creek lends itself to low DO, and the high turbidity also prevents algae from producing oxygen.

Beaver Creek

Elevated ammonia levels cause a concern in the Wichita River below the Lake Kemp Dam (0216). This is possibly due to water releases from the bottom of the lake, which typically are more enriched with nutrients from agribusiness activities in the watershed.

Segments 0218 and 0218A, North Fork and Middle Fork of the Wichita River, contain naturally occurring selenium, a chronic condition with little hope of improvement.

Segment 0226 is the South Fork of the Wichita River from the King County line to a low-water dam approximately six miles east of Guthrie. Screening for the 305(b) report displayed a nutrient enrichment concern for ammonia. This could be attributed to possible runoff during rainfall events since it serves as a water source for livestock.

Utilizing the Mobile Lab

The delineation of **Reach III** begins in northern Wichita County and proceeds westward toward Floyd and Briscoe Counties, involving the Pease River watershed from the confluence with the Red River to its headwaters, including the Red River main stem from the confluence of Cache Creek upstream to the confluences of Buck Creek and the Red River. The reach measures 195 miles long to a maximum of 50 miles wide. Vernon and Burkburnett are the two largest cities in this reach with populations of 11,660 and 10,927 respectfully. There are approximately 21 cities below 10,000 with Childress, Floydada, Quanah, and Paducah among the largest. The population of Reach III is approximately 130,000. This is a predominately rural area comprising agribusiness and oil and gas production. Only two small lakes are located in this reach: Lake Pauline and Lake Copper Breaks, both in Hardeman County. Five subwatersheds in Reach III have 5,734 square miles of contributing drainage.

Five classified stream segments (0205, 0206, 0220, 0221, and 0227) are in this basin reach. There are 27 permitted municipal and industrial dischargers, 14 permitted solid waste disposal sites, 1,399 petroleum storage tanks, and about four CAFOs. The Authority conducted 64 monitoring events and evaluated 2,254 parameters from the nine water quality monitoring stations (five routine and four systematic) that provided data for screening in Reach III.

The Red River below the Pease River (Segment 0205) is experiencing excessive algal growth which creates a concern. Additionally, it was listed on the 2000 303(d) List of Impairments for elevated bacterial levels, but will not be included on the 2002 303(d) list because it is currently meeting the stream standards. This portion of the Red River receives treated municipal wastewater that may have contributed to these elevated parameter levels.

Segment 0220, which comprises the Upper Pease and North Fork of the Pease River has shown thermal modifications and elevated ammonia levels. The unmanageable drought conditions in this area may have provoked this concern. When water was existent in the stream, it was shallow, causing extreme temperature fluctuations and highly concentrated constituents. Likewise, the same is true for Segment 0221, the Middle Fork of the Pease River.

Paradise Creek in Segment 0230A, just east of Vernon, is a small perennial creek that has experienced elevated levels of bacteria. This rural, farming area experiences animal intrusions into the creek and has a permitted discharger located upstream of the sampling site. Additional sampling data and further investigations are scheduled for this site in the future.

Reach IV begins in Childress County at the Texas/Oklahoma state line and continues through the Panhandle to Deaf Smith and Parmer Counties at the New Mexico state line extending about 175 miles and 60 miles at its widest. The reach encompasses the Prairie Dog Town Fork of the Red River from the confluence of Buck Creek. The Caprock Escarpment intersects the center of this mostly rural reach, intermittently sprinkled with farms and ranches. However, the uppermost part of the reach dissects the City of Amarillo, which is also the largest city in the Red River Basin. Hereford and Canyon have populations of 14,597 and 12,875 respectively. Approximately 20 towns with populations below 10,000 are enveloped in this reach including Dimmitt, Friona, Tulia, Wellington, and Claude to list a few. The population of Reach IV is about 200,000 people. Below the western area of this reach lies the Ogallala Aquifer. Accordingly there are only about six small reservoirs in the entire reach. They include Baylor Lake and Lake Childress in Childress County, Mackenzie Reservoir on the Briscoe/Swisher County line, and Buffalo Lake, Bivins Lake, and Lake Tanglewood in Randall County.

Five subwatersheds totaling 7,626 square miles of contributing drainage lie within Reach IV. It contains three classified stream segments (0207, 0228, and 0229), 78 permitted municipal and industrial discharges, 17 permitted solid waste disposal sites, about 2,886 petroleum storage tanks, and 63 CAFOs. Nine water quality monitoring stations (seven routine and two systematic) have provided data for screening in Reach IV. The Authority conducted 48 monitoring events and evaluated 1,832 parameters during the past year.

Mackenzie Reservoir, located in Segment 0228, provides credence to the Clean Rivers Program in that it will not be included on the 2002 303(d) list. Data from the past five years substantiated that its previous listing for elevated levels of TDS has dropped to normal levels during that period.

The Upper Prairie Dog Town Fork of the Red River (0229) is experiencing concerns regarding bacteria, nitrate plus nitrite, orthophosphorous, and total phosphorus. The uppermost perennial reaches of the fork run through the Palo Duro Canyon and commingle with runoff from an upstream municipal wastewater treatment discharge. Thus, the bacteria that enter the stream from the fork or the wastewater treatment plant encounters a virtual bacteria smorgasbord. Since phosphorus is most likely a human pollutant and the one limiting factor in microbial and algal growth, elevated levels of phosphorus combined with the fertilizer effects of nitrates and nitrites encourage bacteria to flourish.

Buck Creek, located in Segment 0207A in Childress County, is also experiencing bacterial concerns. This perennial stream is located in a rural area in which cattle graze and drink from the creek. Because of drought conditions, cattle and carnivorous animals such as coyotes presumably stay near the creek contaminating it with offal. Another possibility of the bacteria content may be a CAFO that lists Buck Creek as a tributary of its receiving waters. Conceivably both factors contribute to the bacterial influx.

Lake Tanglewood in Segment 0229A, has experienced concerns for nitrate plus nitrite, orthophosphorous, total phosphorus, and excessive algal growth. It is located downstream of the Buffalo Lake Wildlife Management Area, which could possibly be a contributor to the elevated levels for these constituents. Leaking septic tank systems could be another possibility.

Further study and subsequent sampling will be pursued during the next year in this reach.

Reach V of the Red River Basin begins at the eastern edge of the Panhandle in Hemphill, Wheeler, and Swisher Counties and journeys westward to Amarillo for about 100 miles. Its maximum width is about 75 miles. The reach contains the North Fork of the Red River upstream to the headwaters of McClellan Creek, including the headwaters of the Salt Fork of the Red, Red River, Elm Fork of the Red River, and the Washita River. Six subwatersheds with a contributing drainage of 7,580 square miles constitute this reach. Also predominately a farming and ranching domain with some oil and gas production, it comprises about 22

small cities below 10,000 people which include Panhandle, Clarendon, Wheeler, and White Deer. The eastern edge of Amarillo is contained in Reach V. Total population in the reach is about 65,000 people. The largest reservoir in the reach is Lake Greenbelt located in Donley County. Lake McClellan, a small lake, is also in the reach which is underlain by the Ogallala Aquifer in the northern and western areas.

Three classified stream segments (0222, 0223, and 0224) and one unclassified segment (0299) are in Reach V. There are 27 permitted municipal and industrial dischargers, 15 permitted solid waste disposal sites, about 4,168 petroleum storage tanks, and 19 CAFOs located here. Seven water quality monitoring stations (six routine and one systematic) provided data for screening the seven monitoring events in which 440 parameters were evaluated.

The only concern on the 305(b) report for Reach V is located in Segment 0299, Sweetwater Creek. The bacteria exceedance was predominately due to the farming and ranching operations in the upper reaches of the creek.

As evidenced by this review, the concerns listed on the 305(b) report are predominately due to the extended drought conditions, naturally occurring problems, and the high level of chlorides. The Environmental Service Division of the Authority works closely with the TNRCC regions and entities within the basin to monitor, sample, and analyze all information received to provide up-to-date data for improved resource management. The Clean Rivers Program contributes toward this effort and provides immeasurable expertise to assist in the control and/or alleviation of these concerns in the Red River Basin.

The Authority's mission is the orderly conservation, reclamation, protection, and development of the water resources throughout the Red River Basin for the benefit of the public.

Water Quality Success Stories in the Red River Basin: Since its inception in 1991 by the Texas Legislature, the Clean Rivers Program has persistently attained many of the goals originally set forth. Red River Authority of Texas has shared in these accomplishments, bearing in mind the myriad obstacles still ahead. However, recognizing that it will continue to be an ongoing process, acknowledging the successes spurs the project onto bigger and better accomplishments for mankind and the environment.

A three-year project initiated in August 2001 between the TNRCC and the Railroad Commission of Texas (RRC) with the objective of eliminating one of the potential sources of the high salinity content in the Red River Basin is now a reality. The ultimate goal is to physically plug 50 inactive noncompliant oil and gas wells in the basin. Thus far, 20 wells have been located and evaluated for plugging by the RRC district offices. At the end of 2001, the RRC had identified and approved twelve wells for plugging. Nine of these wells have been plugged at a total cost of $17,670. An underlying achievement is the interagency cooperation of several governmental agencies working cooperatively to attain a better environment for the people of Texas. The goal for 2002 is to plug 25 additional wells.

The federally funded Chloride Control Project, although somewhat encumbered by voluminous studies, continues to progress. The *Wichita River Basin Project Reevaluation*, which is an evaluation of the overall effectiveness of the implemented control features and the environmental impact of reducing chloride levels in the watershed, is scheduled for release by the USCOE in June 2002. The studies completed by the USCOE indicate a benefit to cost ratio of more than 2:1. A recent selenium study indicated that selenium does not pose a threat to water fowl at Truscott Lake as the natural resource agencies once believed. These positive reports indicate through good science that the reduction in chlorides does not adversely affect wildlife at Truscott Lake, which favorably supports the continuation of the Chloride Control Project.

An *Assessment of Brush Management/Water Yield Feasibility for the Wichita River Watershed above Lake Kemp* accomplished in cooperation with the Texas State Soil and Water Conservation Board was completed last year. The study delineated the watershed to establish baseline criteria for determining the feasibility of implementing a brush control and management program to increase watershed yield. The scope of the study focused on general hydrology and geology of the watershed, changes in general land use and cover characteristics, quantifying the availability of surface and ground water, possible impacts to water quality, the environment and ecosystem, and benefits that may be gained as a result of implementation. The results of the study revealed that implementation of the proposed brush control program may be expected to provide a net increase in overall watershed yield at Lake Kemp from a minimum of 27.6% to a maximum of 38.9% with a defined improvement in water quality. Additional information on the brush study is obtainable from our website at www.rra.dst.tx.us.

The Authority is currently preparing a similar brush study on the Little Wichita River Basin above Lake Arrowhead and Lake Kickapoo in Reach II of the basin. It encompasses the counties of Archer, Baylor, Clay, and a small portion of Wichita. The study is emerging to be as beneficial to the ecosystem as the previous brush study. The proposed date of completion is December 2002.

An underlying achievement is the interagency cooperation of several governmental agencies working cooperatively to attain a better environment for the people of Texas.

Leveraging funds by utilizing information and preparing studies that complement other projects associated with the environment have perpetually been employed by the Authority. Due to the diversity and size of the Red River Basin, the Authority prudently utilizes any project available to maintain our mission to conserve, reclaim, protect, and develop the water resources within the basin. The knowledge base obtained through the CRP enabled more accurate predictions regarding implementation of programs based on good science rather than speculation. Conversely, projects such as the brush studies provide additional data that otherwise could not have been obtained and have proven beneficial to the people of the Red River Basin without cost to the stakeholders.

Many of the concerns and impairments on the 305(b) report are directly related to the drought conditions that have plagued this area of Texas for the past several years. While people who live in the western reaches of the basin have habitually conserved water throughout the years primarily because it is not abundant, individuals in the eastern and central portions of the Red River basin are beginning to accept the ultimate fact that water is indeed precious and must be conserved. Through the adversity of drought conditions, mankind is slowly beginning to appreciate the value and finite availability of potable water.

The Authority is fully aware that feasible solutions can only be identified through continual strategic water quality monitoring, analysis, and planning with support of the people. Water quality data collected in the Red Basin utilize stringent quality assurance protocols to provide vital information necessary for the development of appropriate water quality standards, prepare an inventory of water quality, develop a list of impaired water bodies, and scrutinize wastewater discharge permits. Our charge is to continue to be good stewards of the resources available in our basin now and for future generations.

Public Participation and Education: An integral component of the successful Clean Rivers Program is the emphasis placed on public participation and education. This forum enables the people to broaden their awareness of water quality conditions, utilize the knowledge and expertise of many, and cooperatively pursue avenues to rectify problems. The Authority portrays an image of service to its constituents with an emphasis on good science, partly attributable to the Clean Rivers Program.

The Basin Advisory Committee (BAC) evolved through the years to a diverse group of

interested individuals from all sectors including agricultural, environmental, industrial, municipal, governmental, and the general public. Opening the door for a county judge, rancher, public works director, and businessman to come together and straightforwardly discuss the needs of their own specific area is immeasurable. The Red River Basin is a long way from Austin, yet these BAC meetings have allowed our voices to be heard, and needs considered. A Basin Advisory Committee meeting was held on June 28, 2001 in Wichita Falls to discuss the special needs of the central and eastern reaches of the basin with an attendance of about 35 people. Likewise, another meeting was held in Amarillo on June 24, 2001 for the people in the western and northern portion of the basin. Approximately 25 people attended this meeting. The differences in the meetings substantiated the size and diversity of the basin. Comprehending the magnitude and dissimilarity between the east and west regions of the basin requires the attention of the populace including the regulatory agencies. That continues to be a major objective of the Authority.

Earth Day - April 2001

The annual Coordinated Monitoring Meeting was held in Wichita Falls last year on March 29, 2001 and provided a workable system that avoided duplication of effort. The monitoring schedule for 2003 was recently discussed at a meeting held on April 4, 2002. All TNRCC field offices, the U.S. Geological Survey, several municipalities, and other water supply organizations participated in these meetings.

On October 11, 2001, the annual Water Resource Conference in cooperation with the Red River Valley Association was held in Wichita Falls. This is a regional water resource conference comprising representatives from Texas, Oklahoma, Arkansas, and Louisiana who come together to focus their energy on water quality and quantity issues that affect the Red River Basin, which encompasses all four states. Representatives of the U.S. Army Corps of Engineers located in Tulsa, Oklahoma, Oklahoma Water Resource Board, U.S. Fish and Wildlife, Texas Parks and Wildlife, Natural Resource Conservation Service, Railroad Commission of Texas, TNRCC, members of the Texas and Arkansas legislature, several local officials, and members of area communities participated in this conference. Informative and dynamic discussions provided an opportunity for a cooperative means of discussing and working toward resolving several issues. A meeting similar in nature is also held in Texarkana in June of each year.

The annual Earth Day event was held last year on April 10-11, 2001 at River Bend Nature Works, an environmental education facility in Wichita Falls. Authority personnel provided presentations on water quality analysis and furnished educational information packets to more than 750 area children. Another event is planned for April 18-19, 2002 with an estimated 800 children scheduled to attend. Bags containing information on water conservation, water quality, and the water cycle will be provided to the participants.

Authority personnel regularly attend and provide presentations to various organizations, clubs, and civic groups to peak interest in awareness of natural resource issues, and particularly to give assistance and provide expertise concerning water conservation.

Educational materials are provided on a first come first served basis as they are available to any schools in the basin that requests them. It is estimated

that at least 75% of the children in the Red Basin have discovered *Major Rivers* and his horse *Aquifer* or participated in a *Think Earth* project.

Holliday HS VEM Class

The Texas Rivers Project has successfully completed its tenth year with some of the original schools still participating. Unfortunately, a limiting factor of this program has been the lack of staff and revenue to meet all the requests from schools desiring to participate. Without a doubt, education about water quality, knowledge of the water cycle, and similar curriculum taught to children beginning at an early age is the key to solving the water needs of the future.

Active involvement in the Clean Rivers Program is encouraged and opened to all interested citizens. The Authority maintains a mailing list of all cities, towns, counties, governmental agencies, water supply corporations, stakeholders, and concerned citizens in the Red River Basin. At least two Basin Advisory Committee Meetings are held annually in the Spring or Summer, usually in Amarillo and Wichita Falls. Anyone interested in participating in the Clean Rivers Program or the Basin Advisory Committee may do so by contacting the Red River Authority of Texas by e-mail, telephone, letter, or fax.

Chillicothe HS VEM Class

Vernon JHS VEM Class

Remember:
The water you are using today is only on loan from your grandchildren.

www.rra.dst.tx.us A virtual encyclopedia of information is available on the Authority's website concerning the Red River Basin. Inventories of facts, data, and information about the basin, its counties, population, and etc. Additionally, a public information repository page will guide you to a wealth of scientific information, numerous other sites, some of which contain digital mapping, legislation, other environmental sites, regional weather, significant reservoir inventory, maps, water glossary and terminology, water use efficiency calculator, and general information. Some of the environmental links include the TNRCC Clean Rivers Program, U.S. Environmental Protection Agency, and U.S. Army Corps of Engineers to name a few. A publications library is also available that includes reports and studies prepared by the Authority. Please take advantage of this valuable resource. The Authority is pleased to be able to provide it to you.

Bellevue ISD Monitoring Site

RRA's Commitment: Red River Authority of Texas was created by the legislature 43 years ago. From its beginning the Authority has endeavored to be of beneficial service to its public concerning water conservation, reclamation, protection, and the development of water resources. The Clean Rivers Program reflects the same goals which have permitted the Authority and TNRCC to utilize this expertise concurrently to assist the public. Staying focused, listening to the stakeholders, and keeping abreast of regulatory issues will enable the Authority through the Clean Rivers Program to reach the goals established in the beginning.

For more information please contact:

Red River Authority of Texas
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2001 Coordinated Monitoring Schedule for the Red River Basin
Table 1

Reach	Segment	Station ID	Mon Resp	Mon Type	Long Description	Cont Flow	Mtls Wtr	Org Wtr	Mtls Sed	Org Sed	Conv	Bact	Inst Flow	Fish Tissue	Field
I	202	10115	RR/RR	IS	Post Oak Creek at FM 1417 SE of Sherman		2		2	2	4	12	12		12
I	202	10118	RR/RR	IS	Pine Creek at FM 2648 near the City of Paris		2		2	2	4	12	12		12
I	202	10120	RR/RR	IS	Pine Creek at US 271 near the City of Paris		2		2	2	4	12	12		12
I	201	10123	RR/GS	RT	Red River Bridge on US 71 at Index, Arkansas	365									
I	201	10123	WC/FO	RT	Red River Bridge on US 71 at Index, Arkansas		1				4	4	4		4
I	202	10125	WC/FO	RT	Red River at US 259 N of DeKalb		1				4	4	4		4
I	202	10126	RR/GS	RT	Red River Bridge at US 271 at Arthur City	365									
I	202	10126	WC/FO	RT	Red River Bridge at US 271 at Arthur City		1				4	4	4		4
I	202	10127	RR/RR	IS	Red River at SH 78 N of Bonham		2		2	2	4	12			12
I	204	10132	RR/GS	RT	Red River at IH 35 N of Gainesville	365									
I	210	10139	WC/FO	IS	Farmers Creek Reservoir (Nocona Lake) Mid-Lake near Dam		2		1		2	2			2
I	202	15318	RR/RR	IS	Bois D'Arc Creek at FM 100 N of Honey Grove		2		2	2	4	12	12		12
I	203	15320	RR/RR	IS	Big Mineral Creek at FM 901 N of Sadler		2		2	2	4	12	12		12
I	204	15447	WC/FO	RT	Moss Lake Spillway, 150 mi W 1201, N Fish Creek Dam						2	2			2
I	202	16123	RR/RR	IS	Choctaw Creek at US 69, 5 mi SE of Denison		2		2	2	4	12	12		12
I	209	16342	WC/FO	RT	Pat Mayse, Upper Lake, SW of Forest Point Rec Area (Midway)		1		1		4	4			4
I	209	16343	WC/FO	RT	Pat Mayse Lake ± 50 mi N of City of Paris Raw Water Intake		1		1		4	4			4
I	202	16001	RR/RR	IS	Pecan Bayou at 1159 6 mi NE of Clarksville		2		2	2	4	12	12		12
I	202	17044	RR/RR	IS	Smith Creek at US 271 upstream of Pine Creek N of Paris		2		2	2	4	12	12		12
II	211	10105	RR/GS	RT	Little Wichita River E Fork at US 82 E of Henrietta	365									
II	211	10105	WC/FO	IS	Little Wichita River E Fork at US 82 E of Henrietta		4		1		4	4	4		4
II	212	10142	WC/FO	IS	Lake Arrowhead Mid-Lake near Dam		2		1		2	2		1	2
II	214	10145	RR/GS	RT	Wichita River at FM 810 W of Byers	365									365
II	214	10145	RR/RR	RT	Wichita River at FM 810 W of Byers		2		2		4	6			6
II	214	10148	WC/FO	IS	Wichita River at End of Eastland Lane		4		1		4	4	4		4
II	214	10150	WC/FO	IS	Wichita River at SH 240		4		1		4	4	4		4
II	214	10151	RR/GS	RT	Wichita River at SH 11 in Wichita Falls	365									365
II	214	10151	RR/RR	RT	Wichita River at SH 11 in Wichita Falls		2		2	2	4	6			6
II	214	10154	RR/RR	IS	Wichita River at FM 368		2		2	2	4	6	6		6
II	214	10155	RR/GS	RT	Wichita River at SH 25	365									365
II	214	10155	RR/RR	RT	Wichita River at SH 25		2		2		4	6	6		6
II	215	10157	WC/FO	IS	Lake Diversion near Dam		2		1		2	2		1	2
II	216	10158	RR/GS	RT	Wichita River at US 183-283 N of Mabelle	365	12	2			12				365
II	216	10158	WC/FO	IS	Wichita River at US 183-283 N of Mabelle		4		1		4	4	4		4
II	217	10159	WC/FO	IS	Lake Kemp near Dam		2		1		2	2			2
II	217	10160	WC/FO	IS	Lake Kemp at Headwaters		2		1		2	2			2
II	218	10161	RR/GS	RT	Wichita River at FM 1919 N of Seymour	365	12	2			12				365
II	218	10161	WC/FO	RT	Wichita River at FM 1919 N of Seymour		4		1		4	4	4		4
II	218	10162	RR/GS	RT	N Wichita River at SH 6 S of Crowell and N of Truscott	365	12	2			12				365
II	226	10185	RR/GS	RT	S Fork Wichita River at SH 6 N of Benjamin	365	12	2			12				365
II	226	10185	WC/FO	RT	S Fork Wichita River at SH 6 N of Benjamin		4		4		4	4	4		4

2001 Coordinated Monitoring Schedule for the Red River Basin
Table 1

Reach	Segment	Station ID	Mon Resp	Mon Type	Long Description	Cont Flow	Mtls Wtr	Org Wtr	Mtls Sed	Org Sed	Conv	Bact	Inst Flow	Fish Tissue	Field
II	226	13635	RR/GS	RT	S Fork Wichita River at Low Flow Dam E of Guthrie	365	12	2			12				365
II	226	13636	RR/GS	RT	S Fork Wichita River at Low Flow Dam 6.6 mi E of Guthrie	365	12	2			12				365
II	218	14900	RR/GS	RT	Middle Wichita River upstream of Forrer Creek, 19 mi NE Guthrie	365	12	2			12				365
II	218	15119	RR/GS	RT	N F Wichita River downstream of Cottonwood Creek near Paducah	365	12	2			12				365
II	214	15120	RR/GS	RT	Beaver Creek at FM 2326 N of Kamay	365									365
II	214	15120	RR/RR	RT	Beaver Creek at FM 2326 N of Kamay		2		2		4	6			6
II	214	15121	RR/RR	RT	Beaver Creek at US 283 / 183 S of Vernon		2		2		4	6	6		6
II	214	16735	WC/FO	IS	Wichita River at Lucy Park upstream of City Maintenance Facility		4		1		4	4	4		4
III	206	10135	WC/FO	IS	Red River at SH 6 N of Quanah		4		1		4	4	4		4
III	205	10134	RR/GS	IS	Red River Bridge on US 288-281 NE of Burkburnett	365	12	2			12				365
III	205	10134	RR/RR	RT	Red River Bridge on US 288-281 NE of Burkburnett						4	4			4
III	220	10165	RR/GS	RT	Pease River Bridge on US 283 N of Vernon	365									
III	220	10165	WC/FO	RT	Pease River Bridge on US 283 N of Vernon		4		4		4	4	4		4
III	220	10167	RR/GS	RT	Pease River Bridge on FM 104 S of Kirkland	365									
III	221	10170	WC/FO	IS	Pease River Middle Fork at US 62-83 S of Childress		4		4		4	4	4		4
III	227	10187	WC/FO	RT	S Fork Pease River at US 62-70 W of Paducah		4		4		4	4	4		4
III	205	16733	WC/FO	IS	Red River at US 183 N of Oklaunion		4		1		4	4	4		4
IV	207	10136	RR/GS	RT	PDTF Red River at US 62-83 N of Childress	365									
IV	207	10136	WC/FO	RT	PDTF Red River at US 62-83 N of Childress						4	4	4		4
IV	228	10188	WC/FO	RT	Lake Mackenzie Mid-Lake near Intake Tower		1	1	1		2	2			2
IV	229	10191	WC/FO	RT	UPDTF Red River at SH 217 in Palo Duro State Park		1				4	4	4		4
IV	229	10192	WC/FO	RT	Lake Tanglewood near Dam, S Amarillo FM 1541, E FM 1151		1		1		4	4			4
IV	207	13637	RR/GS	RT	LPDTF Red River at SH 207, 26 Miles S of Claude	365									
IV	207	13637	RR/RR	RT	LPDTF Red River at SH 207, 26 Miles S of Claude		2		2	2	4	12	12		12
IV	207	15811	RR/RR	IS	Buck Creek at US 83, 19 Miles N of Childress		2		2	2	4	12	12		12
IV	229	16870	RR/RR	IS	Tierra Blanca Creek, S of Dawn on CR BB		2		2	2	4	12	12		12
V	299	10070	RR/GS	RT	Sweetwater Creek at FM 592 E of Wheeler	365									
V	222	10076	WC/FO	RT	Lelia Lake Creek at FM 2471 NE of Lelia Lake						4	4	4		4
V	222	10171	RR/GS	RT	Salt Fork Red River Bridge at US 83 N of Wellington	365					4	4			
V	222	10171	WC/FO	RT	Salt Fork Red River Bridge at US 83 N of Wellington			1			4	4	4		4
V	223	10173	WC/FO	RT	Greenbelt Reservoir near Intake Structure at Dam N of Clarendon		1		1		2	2			2
V	224	10178	RR/GS	IS	N Fork Red River Bridge at US 83 N of Shamrock						4	4			
V	224	10178	WC/FO	RT	N Fork Red River Bridge at US 83 N of Shamrock						4	4	4		4

Reach: Hydrologic Subdivision of Basin
Segment: Section of River Sampling Site is Located
Station ID: TNRCC ID Numbers
Mon Type: Type of Sampling Event
(IS) Intensive/Systematic – subwatershed monitoring on a cyclical basis
(RT) Routine Water Sampling / Baseline – long term monitoring
Long Description: Description of Sampling Site

SC1 Entity Responsible for Sampling:
(RR) Red River Authority of Texas
(WC) Texas Natural Resource Conservation Commission
SC2 Entity Conducting Sampling:
(RR) Red River Authority of Texas
(FO) Texas Natural Resource Conservation Commission Regional Office
(GS) United States Geological Survey
(CR) Canadian River Municipal Water Authority

Cont Flow: Streamflow measurements taken continuously by USGS
Mtls Wtr: Dissolved Metals in Water and Total
Org Wtr: Organics in water (TNRCC is doing MTBE)
Mtls Sed: Total Metals in Sediment
Org Sed: Chlorinated pesticides (method in water), sampling events
Conv: Nutrient and mineral sampling events
Bact: Fecal coliform and E. coli sampling events
Inst Flow: Instantaneous Flow measurements at time of sampling
Fish Tissue: TNRCC analysis on Fish Tissue
Field: Field measured sampling events; DO, Temperature, pH, etc.

Red River Basin – Review of Concerns and Impairments
Table 2

Segment	Water Body	Cause(s) of Concern / Impairment	TMDL Priority / Level of Support	# Samples	# Samples Exceeding Criteria
0201	Lower Red River	No Concerns or Not Assessed	N/A	N/A	N/A
	Mud Creek, Entire Length	Elevated Bacteria	Low / Not Supporting	12	3
0201A	Mud Creek is a small spring-fed perennial creek in Bowie County. During periods of prolonged heat and drought, this creek becomes intermittent with perennial pools in sections that normally flow. Heavily used by cattle for watering, this creek is also frequently used by beavers who have dammed the creek in places, causing stagnation of the creek, possibly due to low or no flow conditions. There is permitted dairy activity in the upper reaches of this creek. The land around the creek is very restricted and due to the low conditions, there is very limited recreational use.				
0202	Red River Below Texoma	No Concern or Not Assessed	N/A	N/A	N/A
0202A	Bois D'Arc Creek	No Concern or Not Assessed	N/A	N/A	N/A
0202C	Pecan Bayou	No Concern or Not Assessed	N/A	N/A	N/A
0202D	* Pine Creek Below Lake Crook to its Confluence with Red River	Ammonia Orthophosphorous * Elevated Bacteria	Concern Concern Low / Not Supporting	10 10 23	6 5 12
	Pine Creek is located outside the City of Paris and receives effluent from one municipal and one industrial discharger. This segment of the creek begins below the dam of Lake Crook. Prior to inflow of Smith Creek, Pine Creek only receives overflow or seepages from the lake or surrounding soils. Although not included in this assessment, Smith Creek is the likely source of the concerns and impairments. Recent data collected on Smith Creek at US 271, just upstream of the confluence with Pine Creek, indicates that the problems originate in Smith Creek and are diluted in Pine Creek. During drought and low flow conditions, the continuous flow from Smith Creek causes inflows back into Pine Creek at 271 creating problems at that site. The extremely high readings at Smith Creek at 271 are diluted by the municipal discharger located downstream of the Smith Creek confluence, however, the dilution is not enough to bring the problem under control.				
0202E	Post Oak Creek Entire Length	Elevated Bacteria	Concern Limited Data	6	N/A
	The geometric mean of the samples exceeded bacteria standards. Post Oak Creek is a perennial creek that runs through the City of Sherman. The creek is highly susceptible to urban runoff during storm events.				
0202F	Choctaw Creek	No Concern or Not Assessed	N/A	N/A	N/A
0203	Lake Texoma Entire Lake	Chlorides In Finished Drinking Water Sulfates in Finished Drinking Water Increased Demineralization Cost Total Dissolved Solids in Finished Drinking Water	Concern Concern Concern Concern	4 4 6 6	4 4 6 N/A
	Problems in the lake stem from naturally occurring sources upstream, including, but not limited to, the Wichita River system on the Texas side of the lake. Inflows from the Washita River, although fresh, are heavy in silts. Recommendation is to continue working with partner agencies toward the completion of the Wichita River portion of the Chloride Control Project to reduce chloride and sulfate loading from these systems. Every sample exceeded drinking water standards.				

Red River Basin – Review of Concerns and Impairments
Table 2

Segment	Water Body	Cause(s) of Concern / Impairment	TMDL Priority / Level of Support	# Samples	# Samples Exceeding Criteria
0203A	* Big Mineral Creek Entire Length	* Elevated Bacteria	Low / Not Supporting	16	5
	Big Mineral is a mostly perennial stream that drains into Lake Texoma. Big Mineral receives inflows from local municipalities and other tributaries. In the heat of summer and during prolonged periods of no rain, this creek may become pooled or exhibit very low flow in some sections. Big Mineral Creek is utilized very heavily by local ranchers for their cattle. Access to this watershed is very limited due to being located upstream of the Hagerman Wildlife Refuge.				
0204	* Red River Above Lake Texoma	Excessive Algal Growth * Elevated Bacteria	Concern Medium / Not Supporting	32 N/A	9 N/A
	Red River in this segment receives inflows (on the Texas side) from the Wichita River, the Little Wichita River, and several small creeks. Upstream of the Ringgold site is a sand mining facility. This type of facility may contribute to the nutrient loading. The Wichita River confluence is also upstream of this site.				
0204B	Moss Lake	No Concern or Not Assessed	N/A	N/A	N/A
0205	* Red River Below Pease River	Excessive Algal Growth * Elevated Bacteria	Concern Low / Not Supporting	14 N/A	6 N/A
	This portion of the Red River receives treated wastewater effluent from a local municipality that may contribute to the nutrient loading.				
0206	Red River Above Pease River	No Concern or Not Assessed	N/A	N/A	N/A
0206A	Groesbeck Creek	No Concern or Not Assessed	N/A	N/A	N/A
0207	Lower Prairie Dog Town Fork Red River	No Concern or Not Assessed	N/A	N/A	N/A
0207A	* Buck Creek, Lower 25 Miles	* Elevated Bacteria	Low / Not Supporting	20	8
	Buck Creek at US 83 is located 19 miles north of Childress in Childress, County. Farmers and cattle operators utilize this creek as a primary source of water for range livestock. One permitted CAFO is listed as having the South Fork of Buck Creek as its receiving waters.				
0208	Lake Crook	No Concern or Not Assessed	N/A	N/A	N/A
0209	Pat Mayse Lake	pH	Use Concern Limited Data	6	1
	Pat Mayse Lake is a public water supply lake near Paris. Limited exceedance data may indicate equipment malfunction.				
0210	Farmers Creek Reservoir (Lake Nocona)	No Concern or Not Assessed	N/A	N/A	N/A

Red River Basin – Review of Concerns and Impairments
Table 2

Segment	Water Body	Cause(s) of Concern / Impairment	TMDL Priority / Level of Support	# Samples	# Samples Exceeding Criteria
	* Little Wichita River	Excessive Algal Growth	Concern	14	8
		* Total Dissolve Solids	Low / Not Supporting	17	N/A
		* Depressed Dissolved Oxygen	Low / Partially Supporting– Limited Data	8	2
0211	The main stem segment is located below Lake Arrowhead. The only time there is any flow is when the City of Wichita Falls releases water for the City of Henrietta or there is a significant rainfall event. In either case, the surge of waters, in an otherwise pooled stagnant river, causes TDS and TSS to increase due to runoff and wave action over previously dried surfaces. Nutrient levels also rise having benefitted from the runoff and the wave action. Several intermittent streams and regulated discharges flow into the river from the dam. Upstream of the Hwy 148 site, flow in this segment is regulated by the City of Wichita Falls as permitted discharges for the City of Henrietta drinking water. Storm water runoff and municipal discharges enter the river downstream of the Hwy 148 site. However, the data and concerns are collected below this site on the East Fork. It is possible that these TDS concerns originate from oilfield intrusions. Also, most of the area below Lake Arrowhead are sparsely populated and access is highly restricted to oilfield, ranchers, and landowners. Try monitoring before and after scheduled releases for all necessary parameters. It is suggested to add new sample sites upstream on the East Fork to aid in locating the problematic areas. ***Consider removing main stem of Little Wichita above Hwy 148 from listing per 40 CFR 131.10 section g, subsection (4).***				
0212	Lake Arrowhead	No Concern or Not Assessed	N/A	N/A	N/A
0213	Lake Kickapoo	No Concern or Not Assessed	N/A	N/A	N/A
0214	Wichita River below Lake Diversion Dam, FM 2393 to one mile above Eastland Lane	Orthophosphorous	Concern	20	7
		Total Phosphorus	Concern	20	8
		Ammonia	Concern	20	9
		Excessive Algal Growth	Concern	20	8
		Nickel in Sediment	Concern	10	8
	The portion of the segment showing concerns is located immediately downstream of a municipal discharger.				
0214A	* Beaver Creek Entire Length	* Depressed Dissolved Oxygen	Low / Partially Supporting Limited Data	54	12
	Beaver Creek is an unclassified water body and a perennial tributary to the Wichita River. It is a highly turbid, freshwater stream with moderate depth. Low dissolved oxygen levels can be attributed to the relatively high turbidity levels and the sluggish nature of the creek. Since sunlight cannot penetrate through the water column, photo synthetic organisms cannot produce adequate oxygen for aquatic life to thrive nor can oxygen be aerated back into the water column due to its impassive nature.				
0214B	Buffalo Creek	No Concern or Not Assessed	N/A	N/A	N/A
0214C	Holliday Creek	No Concern or Not Assessed	N/A	N/A	N/A
0215	Lake Diversion	No Concern or Not Assessed	N/A	N/A	N/A

Red River Basin – Review of Concerns and Impairments
Table 2

Segment	Water Body	Cause(s) of Concern / Impairment	TMDL Priority / Level of Support	# Samples	# Samples Exceeding Criteria
0216	Wichita River below Lake Kemp Dam Entire Length	Ammonia	Concern	60	16
	It is possible that lake water releases are from the bottom of the lake, which are more enriched with nutrients from increased use by migratory water fowl.				
0217	Lake Kemp	No Concern or Not Assessed	N/A	N/A	N/A
0218	* North Fork Wichita River	* Selenium, Chronic	Medium / Not Supporting	47	N/A
	Selenium is naturally occurring in this segment. ***Should consider removing from listing per 40 CFR part 136.10 section g subsections 1 and 6*** because the source(s) can be attributed to possible selenium-rich strata, where the selenium is leached out of the soils by ground water or to a possible contamination by an old copper smelting operation. Other possible but less likely sources are exhausts from the coal fired power plant located in Wilbarger County. Selenium occurs naturally in several states, some toxic, some not. Determine percentages of selenium compounds that occur. Check sediments and soils surrounding areas for same. Add additional monitoring at established stations downstream of this segment including the upper reaches of Lake Kemp to determine selenium compound percentages in water and in sediments. Additionally, perform selenium analyses on fish tissues and aquatic plants. Lake Kemp is where Lake Truscott will be in 30 years.				
	Middle Wichita River	Selenium, Chronic	Medium / Not Supporting	47	N/A
0218A	Selenium is naturally occurring in this segment. ***Consider not including on the 2002 CWA 303(d) list, per 40 CFR part 136.10 section g subsections 1 and 6*** because the source(s) can be attributed to possible selenium-rich strata, where the selenium is leached out of the soils by ground water or to a possible contamination by an old copper smelting operation. Other possible but less likely sources are exhausts from the coal fired power plant located in Wilbarger County. Selenium occurs naturally in several states, some toxic, some not. Determine percentages of selenium compounds that occur. Check sediments and soils surrounding areas for same. Add additional monitoring at established stations downstream of this segment including the upper reaches of Lake Kemp to determine selenium compound percentages in water and in sediments. Additionally, perform selenium analyses on fish tissues and aquatic plants. Lake Kemp is where Lake Truscott will be in 30 years.				
0219	Lake Wichita	No Concern or Not Assessed	N/A	N/A	N/A
0219A	Holliday Creek above Lake Wichita	No Concern or Not Assessed	N/A	N/A	N/A
0220	Upper Pease / North Fork Pease River	Thermal Modifications Ammonia	Use Concern Concern	30 14	4 6
	This is a perennial stream maintained by natural flowing salt springs. Drought-like conditions combined with the naturally occurring elevated levels of salts in the watershed created these problems. The Pease River is only a few inches deep or otherwise dry. ***Consider removing segment from listing since this is a naturally occurring condition per EPA 40 CFR part 131.10 section g subsections g-1, 2, and 4.***				

Red River Basin – Review of Concerns and Impairments
Table 2

Segment	Water Body	Cause(s) of Concern / Impairment	TMDL Priority / Level of Support	# Samples	# Samples Exceeding Criteria
0221	* Middle Fork Pease River	* Thermal Modifications	Low / Partially Supporting Limited Data	7	1
	This is a perennial stream maintained by natural flowing salt springs. Drought-like conditions combined with the naturally occurring elevated levels of salts in the watershed created these problems. The Pease River is only a few inches deep or otherwise dry. ***Consider removing segment from listing, since this is a naturally occurring condition per EPA 40 CFR part 131.10 section g subsections g-1, 2, and 4.***				
0222	Salt Fork Red River	No Concern or Not Assessed	N/A	N/A	N/A
0222A	Lelia Lake Creek	No Concern or Not Assessed	N/A	N/A	N/A
0223	Greenbelt Lake	No Concern or Not Assessed	N/A	N/A	N/A
0224	North Fork Red River	No Concern or Not Assessed	N/A	N/A	N/A
0225	M^{c}Kinney Bayou	No Concern or Not Assessed	N/A	N/A	N/A
0226	South Fork Wichita River King County Line to Low-Water Dam 6.6 Miles East of Guthrie and Low-Water Dam to ½ mile Upstream	Ammonia	Concern	97	54
	Possible runoff from cattle or farming by-products. Cattle use this river for a water source.				
0227	South Fork Pease River	No Concern or Not Assessed	N/A	N/A	N/A
0228	* Mackenzie Reservoir	* Total Dissolved Solids	Low / Considered for Delisting	11	1
	Mackenzie Reservoir is currently being considered for removal from the CWA 303(d) list.				
0229	Upper Prairie Dog Town Fork Red River, SH 207 to Palo Duro Canyon State Park North Boundary	Elevated Bacteria Nitrate + Nitrite Orthophosphorous Total Phosphorus	Concern Concern Concern Concern	7 21 21 20	3 13 14 12
	This site is downstream of a wastewater treatment plant. This area is heavily used by cattle as a water source. Access is extremely limited because of the nature of the topography.				

Red River Basin – Review of Concerns and Impairments
Table 2

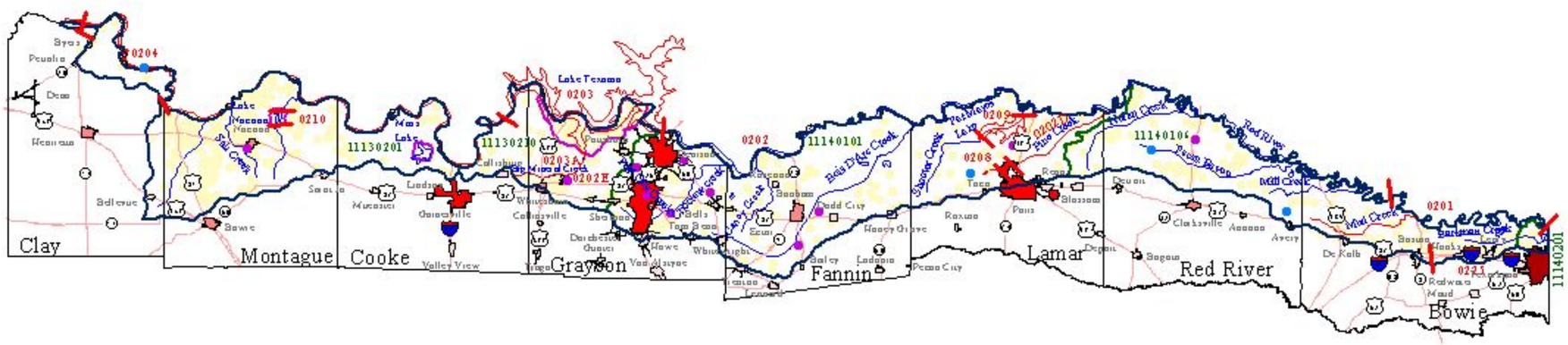
Segment	Water Body	Cause(s) of Concern / Impairment	TMDL Priority / Level of Support	# Samples	# Samples Exceeding Criteria
0229A	Lake Tanglewood	Nitrate + Nitrite	Concern	22	18
		O-Phosphorus	Concern	22	20
		T-Phosphorus	Concern	22	19
		Excessive Algal Growth	Concern	22	8
	This site is downstream of the Buffalo Lake Wildlife Management Area. Other possibilities causing the elevated levels could be due to leaching or leaking septic systems.				
0230	Pease River	No Concern or Not Assessed	N/A	N/A	N/A
0230A	Paradise Creek	Elevated Bacteria	Concern – Limited Data	13	6
	The monitoring site is located downstream of a permitted wastewater discharger. This site is situated just upstream of a CAFO. Also upstream of the site is an intense farming and ranching area.				
0299	Sweetwater Creek	Elevated Bacteria	Use Concern Limited Data	8	3
	This creek maintains high quality water. Flow is seasonally dependent and occasionally dammed by beavers. Farmers and ranchers utilize this creek as a water source for their livestock. Cattle have direct access to the creek. At least one CAFO is located in the watershed. Because of the rural nature of the site and the surrounding area, there is very limited access to the area upstream and downstream of this site.				

* **Indicates that the stream / water body and parameter were listed on the 2000 Clean Water Act's 303(d) list.**

Reach I	Reach II	Reach III	Reach IV	Reach V

RED RIVER BASIN

FACTORS INFLUENCING WATER QUALITY



N

W E

S

Reach I

20 0 20 40 Miles

305(b) SCREENING CONCERNS

SEGMENT	CONCERN
0201A	Bacteria
*0202D	Ammonia, Orthophosphorous, *Bacteria
0202E	Bacteria
0203	Chlorides, Sulfates, Total Dissolved Solids, (As compared to DW standards), Demineralization Cost
*0203A	*Bacteria
*0204	Algal, *Bacteria
0209	pH

* Also on the 303(d) list

- Solid Waste Disposal Facilities
- Concentrated Animal Feeding Operations
- Segments
- Boundary

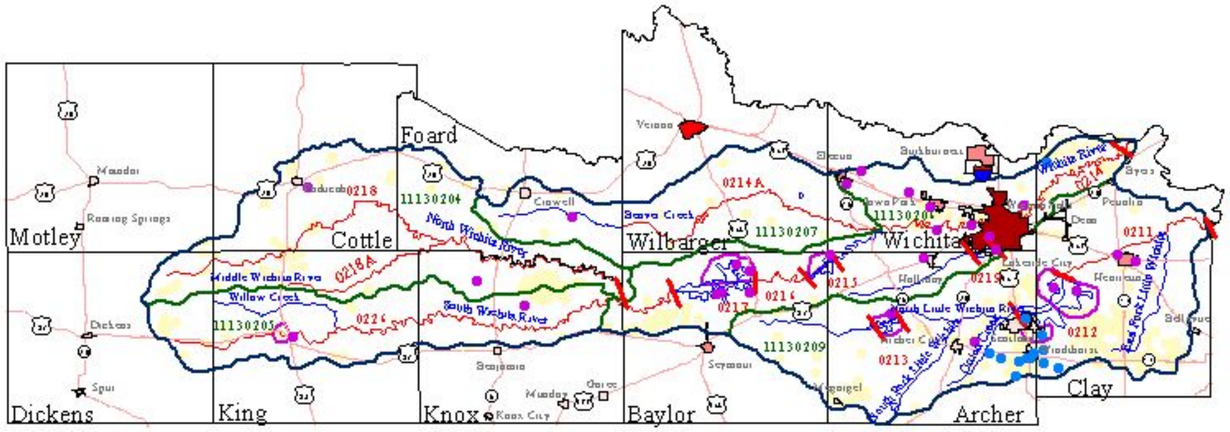
Population
- 0 - 2826
- 2827 - 10875
- 10876 - 34395
- 34396 - 101986
- 101987 - 172289

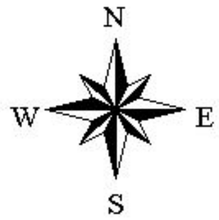
- Hydrologic Unit Boundary
- Counties
- Highways
- 2002 305(b)/303(d) List
- Hydrology
- Concentrated Septic Tanks Area
- Groundwater Wells

Figure 1

RED RIVER BASIN

FACTORS INFLUENCING WATER QUALITY





Reach II

20 0 20 40 Miles

- Solid Waste Disposal Facilities
- Concentrated Animal Feeding Operations
- Segments
- Boundary

Population

- 0 - 2826
- 2827 - 10875
- 10876 - 34395
- 34396 - 101986
- 101987 - 172289

- Hydrologic Unit Boundaries
- Counties
- Highways
- 2002 305(b)/303(d) List
- Hydrology
- Concentrated Septic Tanks Area
- Groundwater Wells

305(b) SCREENING CONCERNS

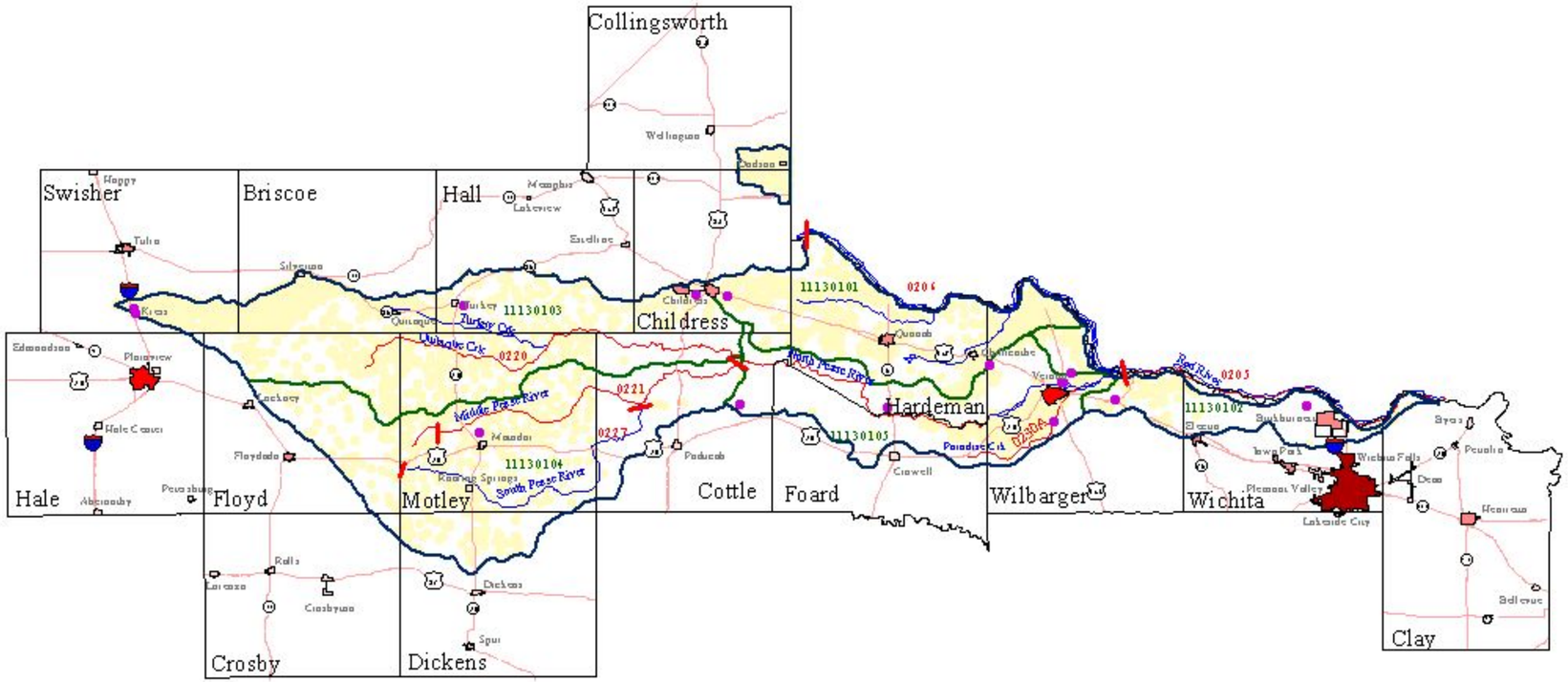
SEGMENT	CONCERN
*0211	Algal, *Total Dissolved Solids, *Depressed Dissolved Oxygen
0214	Orthophosphorous, Total Phosphorous, Ammonia, Algal, Nickel in Sediment
*0214A	*Depressed Dissolved Oxygen
0216	Ammonia
*0218	*Selenium (Chronic)
0218A	Selenium (Chronic)
0226	Ammonia

* Also on the 303(d) list

Figure 2

RED RIVER BASIN

FACTORS INFLUENCING WATER QUALITY



N

W E

S

Reach III

20 0 20 40 Miles

305(b) SCREENING CONCERNS

SEGMENT	CONCERN
*0205	Algal, *Bacteria
0220	Thermal Modifications, Ammonia
*0221	*Thermal Modifications
0230A	Bacteria

*Also on the 303(d) list

- Solid Waste Disposal Facilities
- Concentrated Animal Feeding Operations
- Segments
- Boundary

Population

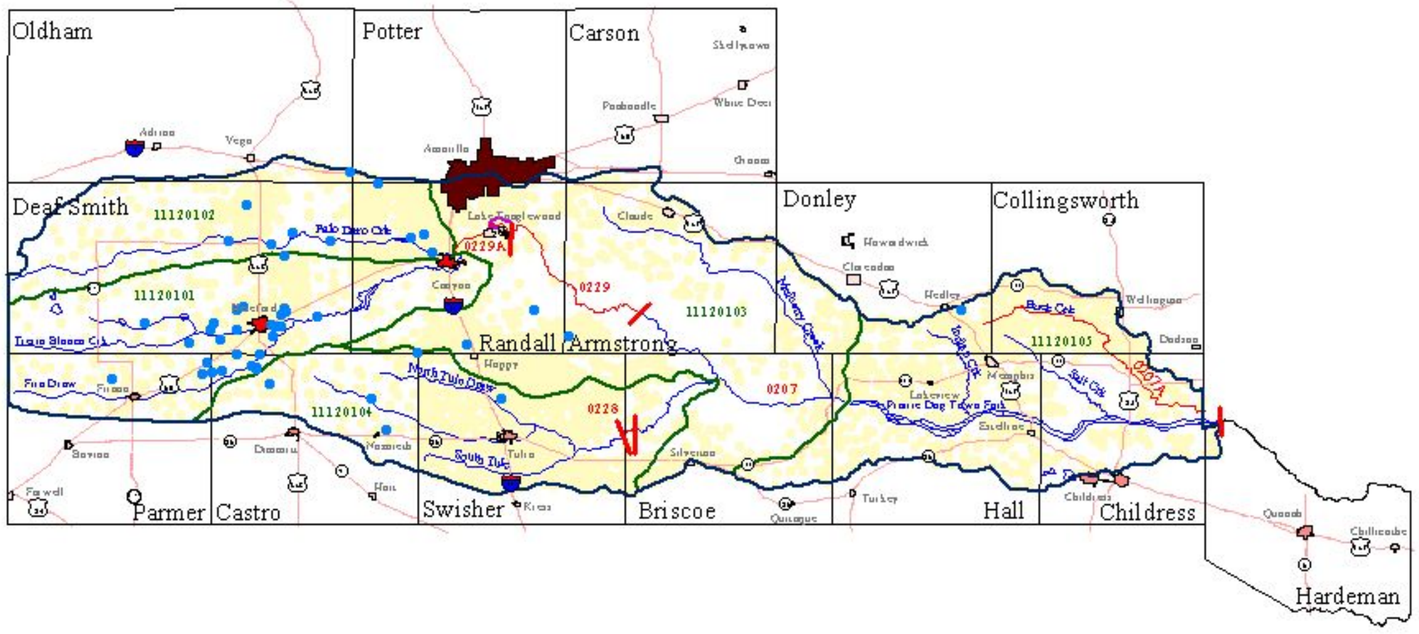
- 0 - 2826
- 2827 - 10875
- 10876 - 34395
- 34396 - 101986
- 101987 - 172289

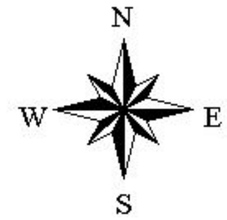
- Hydrologic Unit Boundaries
- Counties
- Highways
- 2002 305(b)/303(d) List
- Hydrology
- Concentrated Septic Tanks Area
- Groundwater Wells

Figure 3

RED RIVER BASIN

FACTORS INFLUENCING WATER QUALITY





Reach IV

20 0 20 40 Miles

- Solid Waste Disposal Facilities
- Concentrated Animal Feeding Operations
- Segments
- Boundary

Population
- 0 - 2826
- 2827 - 10875
- 10876 - 34395
- 34396 - 101986
- 101987 - 172289

- Hydrologic Unit Boundaries
- Counties
- Highways
- 2002 305(b)/303(d) List
- Hydrology
- Concentrated Septic Tanks Area
- Groundwater Wells

305(b) SCREENING CONCERNS

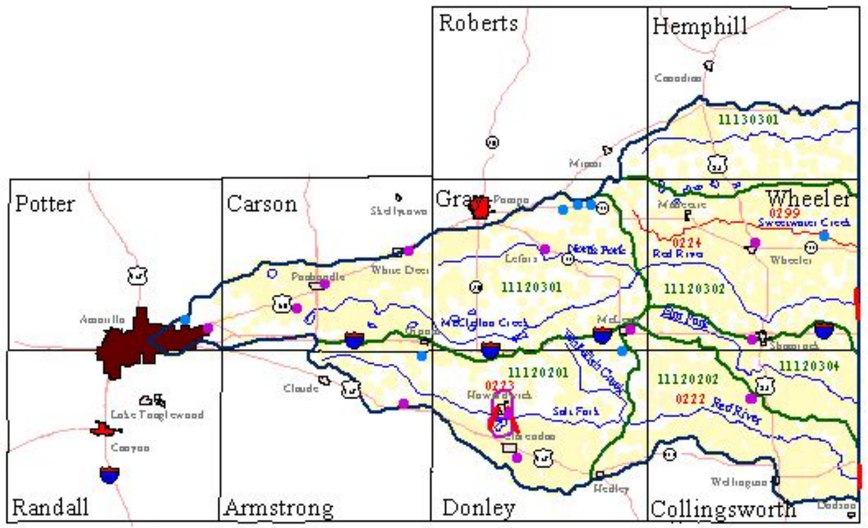
SEGMENT	CONCERN
*0207A	*Bacteria
*0228	*Total Dissolved Solids
0229	Bacteria, Nitrate+Nitrite, Orthophosphorous, Total Phosphorous
0229A	Nitrate+Nitrite, Orthophosphorous, Total Phosphorous, Algal

* Also on the 303(d) list

Figure 4

RED RIVER BASIN

FACTORS INFLUENCING WATER QUALITY



N

W E

S

Reach V

20 0 20 40 Miles

- Solid Waste Disposal Facilities
- Concentrated Animal Feeding Operations
- Segments
- Boundary

Population

- 0 - 2826
- 2827 - 10875
- 10876 - 34395
- 34396 - 101986
- 101987 - 172289

- Hydrologic Unit Boundaries
- Counties
- Highways
- 2002 305(b)/303(d) List
- Hydrology
- Concentrated Septic Tanks Area
- Groundwater Wells

305(b) SCREENING CONCERNS

SEGMENT	CONCERN
0299	Bacteria

*Also on the 303(d) list

Figure 5