BASIN HIGHLIGHTS REPORT
CANADIAN RIVER BASIN
Red River Authority of Texas

April – 2005

INTRODUCTION

In 1991 a group representing the major river basins in Texas gathered in Austin at the Texas Water Commission[1] to address the newly adopted rules under Chapter 320 of the Texas Water Code enacted by the Legislature under Senate Bill 818. While a few were skeptical, most shared the excitement of embarking on a new adventure and pledged to work together to achieve its goals. The Texas Clean Rivers Program was born. Red River Authority of Texas assumed a leadership role in tackling the myriad issues and researching information required to undertake the program on a solid foundation. Now, fourteen years later, the Authority continues to monitor the Canadian River Basin, discover its secrets, analyze samples, and interpret trends in the daily function of its mission – *the orderly conservation, reclamation, protection, and development of the water resources throughout the Canadian River Basin for the benefit of the public.*

The ***Basin Highlights Report*** is prepared annually to provide the stakeholders and people of the Canadian River Basin with a concise overview of the water quality conditions and issues throughout the basin. Water quality education is the key function of the report, and is an integral part of the **Texas Clean Rivers Program**.

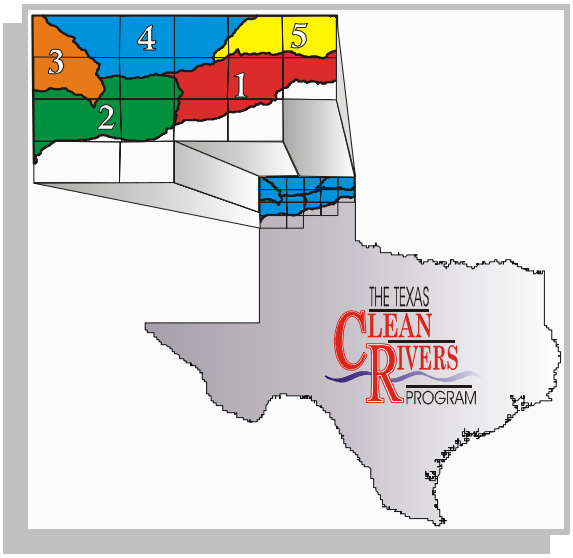


Figure 1

OVERALL APPROACH TO WATER QUALITY

To expedite planning, monitoring, geographical analysis, and dissemination of data, the Authority divided the basin into five reaches (see **Figure 1**). A five-year rotational approach was developed to adequately monitor the aquatic health of the basin. This rotational approach provides emphasis to be given to a different reach per year, ultimately intensively covering the entire basin over the five-year time span. In addition, to achieve the goals of the five-year plan, the Authority has coordinated collection and monitoring efforts with other entities, including the Canadian River Municipal Water Authority (CRMWA), the Texas Commission on Environmental Quality (TCEQ), and the U.S. Geological Survey (USGS).

The Canadian River Basin Highlights Report was Prepared with and Financed through Grants from the Texas Commission on Environmental Quality

[1] Texas Natural Resource Conservation Commission (1994-2002), Texas Commission on Environmental Quality (2003-)

MAJOR WATER ISSUES WITHIN THE CANADIAN RIVER BASIN

Even with increased rainfall and rising lake levels there are three major issues within the Canadian River Basin. They are the drought and excessive chloride levels, and an increasing number of segments with bacteria and nutrient issues. Although there is no quick fix for these issues, the Authority and the citizens within the Canadian River Basin are working toward managing these problems.

Although drought conditions have eased somewhat in areas of the basin with the abundant rainfall last year, overall conditions statewide are still struggling and have not yet fully recovered. The following **Table 1** depicts the capacity of the major reservoirs versus the current percentage of capacity within the basin. Many have not been at capacity for several years and although some lakes and/or ponds received sufficient rainfall/run off, others remain uncomfortably lower than normal. The abundance of rain over large portions of the Canadian River Basin has been beneficial and has significantly improved many problems that have been caused by the continued drought. Until the drought is broken across the whole basin, precautions still need to be taken to maintain a sufficient supply of good quality water to serve the needs of the people within the Canadian River Basin.

TABLE 1 – MAJOR RESERVOIRS*
TOTAL CAPACITY VERSUS CURRENT CAPACITY PERCENTAGE

RESERVOIR	COUNTY(S)	CAPACITY ACRE/FEET	CAPACITY PERCENTAGE
Lake Meredith	Potter, Moore, Hutchinson	500,000	33%
Palo Duro Reservoir	Hansford	60,900	7%

** as of 11/2004-Texas Water Development Board*

Lake Meredith's capacity has dropped significantly since 2001. Completed in 1965, the lake serves as a municipal water supply to eleven West Texas cities: Amarillo, Borger, Brownfield, Lamesa, Levelland, Lubbock, O'Donnell, Pampa, Plainview, Slaton, and Tahoka.

The Palo Duro Reservoir, located in Hansford County, was completed in 1991 by impounding the waters of Palo Duro Creek. The reservoir reached capacities within the range of 50% to 60% during 1999, but has since fallen drastically due to the lack of rainfall and high evaporation rates.

Although the Authority does not monitor the ground water beneath the Canadian River Basin, it is an important aspect of the lives of many of the citizens that live and work in the basin. Fortunately, most of the counties within the Canadian River Basin are heavily underlain by the vast Ogallala Aquifer. However, there are a few areas where it is not as abundant. Groundwater availability in some areas is less due to the fact that the Canadian River has eroded through the Ogallala formation. An observation well located in southwest Castro County provides information concerning the depth of the Ogallala Aquifer on a monthly basis. In December 2004, the aquifer level was recorded 260' below land surface, which is well below the 150' mark in 1970. This drastic drop over the 34 year period is testimony to the increased usage and decreased recharge. Underground water districts have been formed to protect this valuable resource.

MAJOR WATER ISSUES WITHIN THE CANADIAN RIVER BASIN (CONTINUED)

The *Lake Meredith Salinity Control Project* is designed to intercept the flow with wells drilled along the river, and then dispose the brine by deep well injection or other means. This project would help to decrease the elevated concentrations of chlorides in Lake Meredith, which is the primary surface water supply for a large portion of the Texas Panhandle. The effectiveness of the Salinity Control Project is a means of reclaiming full benefit of the resource. Treated discharges are monitored closely to ensure the impact to receiving waters is compatible with the ecosystem and maintains balance with natural habitats.

While regional activities impact the local watersheds, site specific problems are intensified by the larger scale influences of naturally occurring and anthropogenic pollution to receiving waters. Watershed runoffs from urban and agricultural activities are also major contributors of pollution and effective control programs are being implemented to reduce adverse impacts resulting from agricultural and livestock practices.

IMPACT AND RESPONSE TO WATER QUALITY ISSUES

As fast as some municipalities and urbanized areas are growing in parts of the Canadian River Basin, the available water supplies will not be able to keep up with this growth. This lack of adequate water supplies has forced municipalities to look for new sources and to research alternative methods of obtaining, purifying, and recycling water. Unfortunately, as sources of good quality water are diminishing, the costs to purify it and maintain water treatment systems' compliance with all state and federal regulations are increasing.

Strategies have been identified in the Canadian River Basin as efforts to reduce the effects of drought conditions. Irrigation strategies specifically identified for farming in the basin include precipitation enhancement, an evapotranspiration network for scheduling irrigation, installation of low energy precision application equipment, changes in crop variety, implementation of conservation tillage methods.

Additionally, groundwater districts propose to develop these rapidly dwindling resources and plans are to draw water from the Dockum Aquifer while awaiting an opportunity to utilize water from the Palo Duro Reservoir.

In response to the salinity problems within the Canadian River and Lake Meredith, the CRMWA continues to work toward controlling the chlorides that enter the river. Disposing of the excess brine into the injection wells has proven to be a successful method of eliminating the salt by the CRMWA. Their goal is to provide additional injection wells to use for this purpose, while searching for other alternatives. Additional information on the CRMWA's *Salinity Control Project* can be found at www.crmwa.com/lmscp2.htm.

OVERVIEW OF WATER QUALITY MONITORING

The Authority's Coordinated Monitoring Meeting is held annually to coordinate sites, parameters of concern, and frequency of collection. This meeting allows for the development of a monitoring schedule that reduces duplicity and maximizes effort and funds available to the monitoring entities. It is an essential element in the successful planning process of the basin and is open to any interested group or entity that would like to attend and/or participate in monitoring in the Canadian River Basin. A summary of the monitoring schedule for the fiscal year 2004 is listed in **Table 2** below. A detailed Coordinated Monitoring Schedule can be found at http://cms.lcra.org.

TABLE 2 – OVERVIEW OF WATER QUALITY MONITORING

Agency	Reach	*Cont Flow	24-Hr DO	Metals Water	Organ Water	Metals Sed	Organ Sed	Conv	Ind Bact	Instant Flow	Field	RT	IS	DI	SS
RRA	I							4	4	4	4	3			
TCEQ	I			4	2			4	4	4	4	2			1
CRMWA	I														
USGS	I														
Total Reach I		—	—	**4**	**2**	—	—	**8**	**8**	**8**	**8**	**5**	—	—	**1**
RRA	II							4	4	4	4	2			
TCEQ	II					2	2	4	4	2	4	4			1
CRMWA	II							12	12		12	16			
USGS	II	365							4			1			
Total Reach II		**365**	—	—	—	**2**	**2**	**20**	**24**	**6**	**20**	**23**	—	—	**1**
RRA	III														
TCEQ	III							4	4	4	4	1			
CRMWA	III														
USGS	III														
Total Reach III		—	—	—	—	—	—	**4**	**4**	**4**	**4**	**1**	—	—	—
RRA	IV														
TCEQ	IV		2					2	2	2	2	1		1	
CRMWA	IV														
USGS	IV														
Total Reach IV		—	**2**	—	—	—	—	**2**	**2**	**2**	**2**	**1**	—	**1**	—
RRA	V							4	4	4	4		3		
TCEQ	V							2	2	2	2	1			
CRMWA	V														
USGS	V														
Total Reach V		—	—	—	—	—	—	**6**	**6**	**6**	**6**	**1**	**3**	—	—
Basin Total		**365**	**2**	**4**	**2**	**2**	**2**	**40**	**44**	**26**	**40**	**31**	**3**	**1**	**2**

Cont Flow . . . . . Continuous Flow
24-Hr DO . . . 24-Hour Dissolved Oxygen
Metals Water . . . . . Metals in Water
Organ Water . . . . Organics in Water
Metals Sed . . . . Metals in Sediment
Conv . . . . . Conventional Parameters
Ind Bact . . . . . Indicator Bacteria
Instant Flow . . . Instantaneous Flow Measurements
Field . . . . . Field Parameters
RT . . . . . Routine Sampling
IS . Intensive/Systematic Sampling
DI . . . . . Diurnal Sampling
SS . . . . . Special Studies

**Continuous flow measurements by the USGS are recorded on an hourly basis.*

OVERVIEW OF WATER QUALITY MONITORING (CONTINUED)

Regular monitoring is necessary to collect quality-assured data to complete an assessment of water quality conditions and impairments. Assessing the data determines whether or not a water body meets its standards. There are four types of monitoring in the Canadian River Basin performed by the Authority, CRMWA, TCEQ, and USGS.

- Fixed or "Routine" monitoring is conducted every year at key sites.
- Systematic or "Intensive" monitoring is conducted at specific sites on the annual reach of focus.
- Diurnal monitoring takes 24-hour dissolved oxygen measurements used to identify problematic areas where additional dissolved oxygen data are needed.
- Special studies are conducted where special attention is required.

Selected physical, chemical, and biological parameters collected by the Environmental Services Division (ESD) of the Authority are analyzed either in the field or at the Authority's environmental laboratory. Within days of collection, the results of the analyses are entered into the data repository, which contains years of quality-assured water resource information on the Canadian River Basin.

There are two primary types of data collected at each sampling site: *field and conventional*. Field parameters are collected and analyzed immediately after collection at the site, while conventional parameters are collected, preserved, and taken back to the laboratory for processing and analysis. **Table 3** provides a list of some of the field and conventional parameters that are currently being collected in the Canadian River Basin.

While the Authority is well equipped with its own environmental laboratory, samples collected by the CRMWA, TCEQ, and USGS are processed by their own in-house laboratories. All sampling entities are required to adhere to a Quality Assurance Project Plan approved by the TCEQ. This ensures that all data collected by the entities sampling within the Canadian River Basin are quality-assured and verified prior to its entry into the statewide data collection system administered by the TCEQ known as TRACS (Texas Regulatory Activity and Compliance System).

TABLE – 3

FIELD PARAMETERS	CONVENTIONAL PARAMETERS
pH	Alkalinity
Dissolved Oxygen	Ammonia
Conductivity	Calcium
Turbidity	Total Organic Carbon
Flow	Chloride
E. coli	Chemical Oxygen Demand
Fecal Coliform	Orthophosphate
Water Temperature	Total Phosphorus
Water Clarity	Sulfate
Water Color	Total Dissolved Solids
Water Odor	Total Suspended Solids
Weather	Volatile Suspended Solids

In addition, the quality-assured data collected by the Authority are entered into the Authority's database and made available on the Authority's website at www.rra.dst.tx.us/data/swqm. This data is utilized to assist entities in making informed decisions about their water resources based on scientifically valid data.

WATER QUALITY REVIEW

The regular program of monitoring and assessment is designed to compare conditions in Texas surface waters to established *water quality standards* and to determine which water bodies are meeting the standards set for their use, and which ones are not. Water quality standards are fundamental building blocks used to manage the quality of surface water. **Table 4** is a brief synopsis of the water quality standards for classified segments in the Canadian River Basin.

TABLE 4
CANADIAN RIVER BASIN
SURFACE WATER QUALITY STANDARDS

Segment Number	Water Body Use			Water Quality Parameter Criteria							
	Contact Recreation	Aquatic Life	Public Water Supply	Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)	Dissolved Oxygen (mg/L)	pH Range (SU)	Indicator Bacteria[1] #/100ml	Temperature (°F)	Temperature (°C)
0101	✓	High		1,975	760	5,000	5	6.5-9.0	126/200	95	35.0
0102	✓	Exceptional	✓	400	350	1,300	6	6.5-9.0	126/200	85	29.4
0103	✓	High		1,050	540	4,500	5	6.5-9.0	126/200	95	35.0
0104	✓	High		420	125	1,125	5	6.5-9.0	126/200	93	33.9
0105	NCR*	Low		200	200	1,000	3	6.5-9.0	126/200	85	29.4

** Segment 0105 - Rita Blanca Lake is the only segment in the Canadian River Basin to be classified as a Noncontact Recreation Segment.*

Water quality standards were established based on historical hydrological data for each classified water body. In the assessment, current water quality data are screened against the standard. The results are then analyzed and evaluated for the assessment. The assessment occurs every two years based on the previous five year's data and the results are published periodically in the *Texas Water Quality Inventory and 303(d) List*, as required by Sections 305(b) and 303(d) of the Federal Clean Water Act. The draft *2004 Texas Water Quality Inventory and 303(d) List* for the entire state of Texas can be viewed at www.tnrcc.state.tx.us/water/quality/04_twqi303d/04_index.html.

The increased rainfall received in 2004 improved the overall water quality conditions throughout the Canadian River Basin. Water resources are good and support healthy and robust aquatic life. Out of the 21 water bodies that were assessed, two water bodies did not support one of their designated uses, (Dixon Creek and Rock Creek for contact recreation) and one partially supported one of its designated uses, (Lake Meredith for fish consumption). **Table 5** presents an overview of the water quality conditions in the Canadian River Basin based on the TCEQ's *Draft 2004 Texas Water Quality Inventory*.

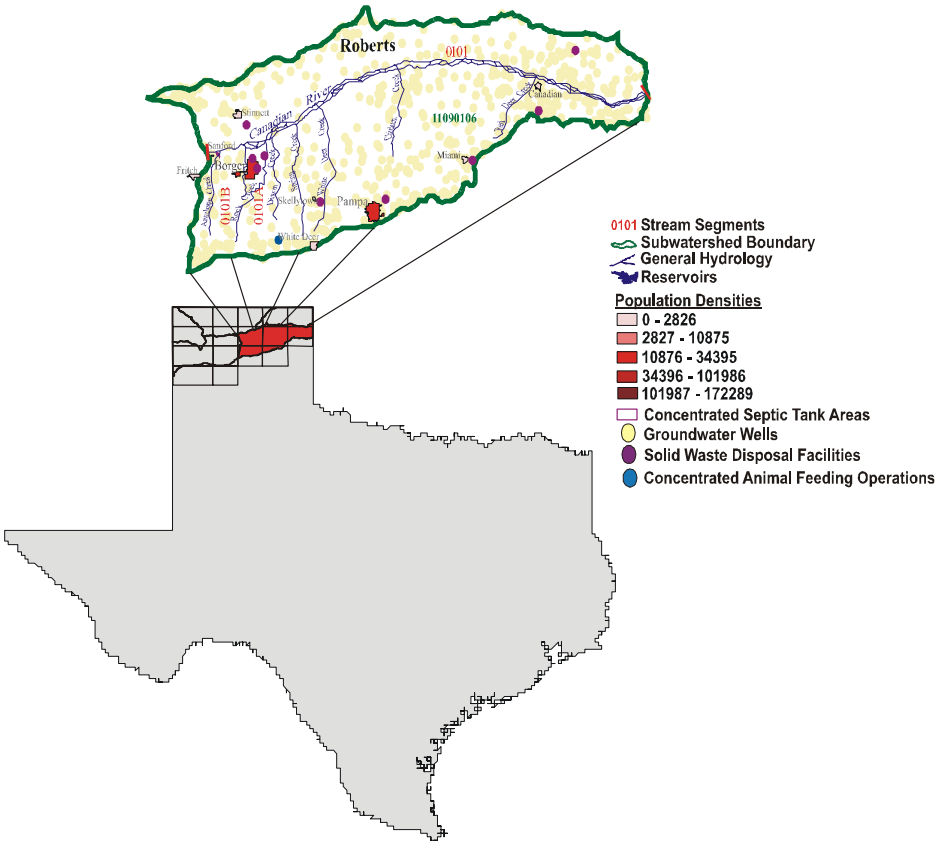
TABLE – 5 CANADIAN RIVER BASIN
STREAM SEGMENTS LISTED ON THE DRAFT 2004 TEXAS WATER QUALITY INVENTORY

SEGMENT NUMBER / DESCRIPTION	AQUATIC LIFE USE	CONTACT RECREATION USE	GENERAL USE	FISH CONSUMPTION USE	PUBLIC WATER SUPPLY USE	OVERALL USE
0101_01 - Canadian River below Lk Meredith - Portion in Hemphill County	FS	FS	FS	NA	NA	FS
0101_02 - Canadian River below Lk Meredith - Portion in Roberts County	FS	FS	FS	NA	NA	FS
0101_03 - Canadian River below Lk Meredith -Portion in Hutchinson County	FS	FS	FS	NA	NA	FS
0101A_01 - Dixon Creek - Entire Water Body	FS	NS	NA	NA	NA	NS
0101B_01 - Rock Creek - Lower 6 Miles	NA	NA	NA	NA	NA	NA
0101B_02 - Rock Creek - Upper 1 Mile	FS	NS	NA	NA	NA	NS
0102_01 - Lake Meredith - Downstream Half of Lake	FS	FS	FS	PS	FS	PS
0102_02- Lake Meredith - Upstream Half of Lake	NA	FS	FS	PS	FS	PS
0102A_01 - Big Blue Creek - Entire Creek	FS	FS	NA	NA	NA	FS
0103_01 - Canadian River above Lake Meredith - Lake Meredith Headwaters to Sand Creek	FS	FS	FS	NA	NA	FS
0103_02 - Canadian River above Lake Meredith - Sand Creek to Punta de Agua Creek	FS	FS	FS	NA	NA	FS
0103_03 - Canadian River above Lake Meredith - Punta de Agua Creek to Sidle Canyon	NA	NA	FS	NA	NA	FS
0103_04 - Canadian River above Lake Meredith - Sidle Canyon to New Mexico State Line	NA	NA	FS	NA	NA	FS
0103A_01 - East Amarillo Creek - Entire Water Body	FS	FS	NA	NA	NA	FS
0103B_01 - Punta de Agua Creek - Lower 25 Miles of Water Body	FS	FS	NA	NA	NA	FS
0103B_02 - Punta de Agua Creek - Remainder of Water Body	NA	NA	NA	NA	NA	NA
0104_01 - Wolf Creek - Oklahoma State Line to Cottonwood Creek	FS	NA	FS	NA	NA	FS
0104_02 - Wolf Creek - Cottonwood Creek to State Highway 23	FS	FS	FS	NA	NA	FS
0104_03 - Wolf Creek - State Highway 23 to Upper End of Segment	NA	NA	FS	NA	NA	FS
0105_01 - Rita Blanca Lake - Entire Water Body	NA	NA	NA	NA	NA	NA
0199_01 - Palo Duro Reservoir - Entire Water Body	FS	FS	NA	NA	NA	FS

FS – Fully Supporting:	NA – Not Applicable or Not Assessed	PS - Partially Supporting	NS – Not Supporting

REACH I of the Canadian River Basin encompasses an area about 90 miles long and 40 miles wide. It is located on the main stem of the Canadian River. It represents a watershed from the Texas-Oklahoma state line upstream to the Sanford Dam on the Canadian River where it encompasses the northern portion of Hemphill County and the southernmost section of Lipscomb County. The largest cities within the reach are Pampa and Borger with populations of 17,887 and 14,302, respectively. Other towns include Canadian, Stinnett, Skellytown, Miami, and Sanford.

More than 1,200 farms and ranches covering more than 2.6 million acres of land produce cattle, swine, poultry, wheat, oats, corn, sorghum, hay, barley, alfalfa, and soybeans. Only about 55,000 acres are irrigated farm land, with the remainder being either dryland farming or pasture land for cattle. The soils range from sandy alluvial to dark and reddish clay loams over flat plain to broken rocky valleys where the plains break into the Canadian River Valley.



Included in **Reach I** are 36 permitted municipal and industrial discharges, 12 permitted solid waste disposal sites, four concentrated animal feeding operations, and an estimated 1,200 septic tanks. In addition, there are more than 2,100 ground water wells which utilize water from the Ogallala Aquifer.

Stream segments located in **Reach I** are:

0101	–	Canadian River below Lake Meredith
0101A	–	Dixon Creek
0101B	–	Rock Creek

During the reference period of September 1, 2003 through August 31, 2004, the Authority conducted 12 monitoring events and collected 291 parameters from three water quality monitoring stations. The TCEQ conducted eight monitoring events and collected 226 parameters from two water quality monitoring stations during the same reference period. **Figure 2** illustrates the monitoring coverage of **Reach I** for 2004.

Depressed dissolved oxygen and pathogens (*E. coli* and fecal coliform) are the main water quality issues in **Reach I**. High nutrient levels are also being revealed in some parts of the reach.

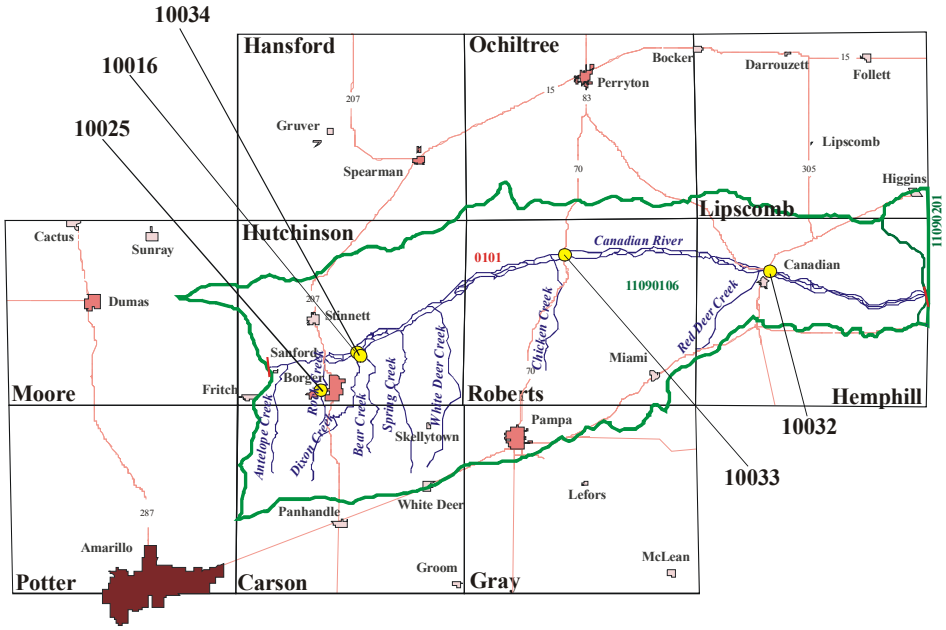
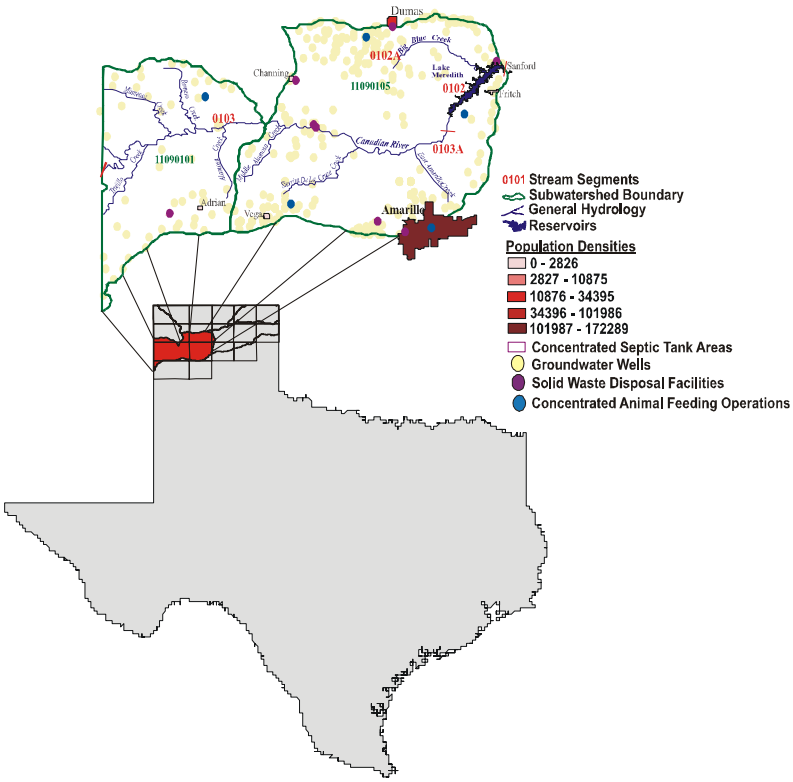


Figure 2

Dixon Creek is a tributary of the Canadian River and is located in the center of the Borger oilfield. It is listed on the TCEQ's *Draft 2004Texas Water Quality Inventory* list of impaired water bodies for bacteria and depressed dissolved oxygen. Recent reviews of the data by the Authority have shown elevated nutrient levels. The creek is heavily utilized by local cattle ranchers as a source of water for their range livestock. Without the flow from an industrial discharger upstream, Dixon Creek would most likely be an intermittent water body. The discharge received by this creek is possibly affecting the depressed dissolved oxygen problem in this water body. The field work of an Aquatic Life Assessment has been completed on Dixon Creek by the TCEQ. Results of the assessment should be available soon.

Rock Creek is located near the community of Bunavista. It receives treated effluent discharge from a local municipal discharger. Recent review of the water quality data by the Authority indicates elevated bacterial levels which may be originating from livestock, as well as runoff from pasture lands. In addition, elevated ammonia nitrogen levels have been found in the upper reaches of this unclassified segment. Coincidentally, there is a fertilizer manufacturing plant that is also located in the upper reaches of Rock Creek that is permitted for deep well injections. However, with all of the drilling in the nearby oilfields, both recent and historic, it is possible that a trickle up or leak effect from an unknown source is contributing to the problem. As one of two major contributors to the flow of the Canadian River in this portion of the segment, it is likely that the nutrient enrichment problems originate in Rock Creek. The results of the recent Aquatic Life Assessment on Dixon Creek will yield invaluable information that could lead to rectification of the water quality problems in Rock Creek.

REACH II is located from the Sanford Dam at Lake Meredith to the Texas-New Mexico state line and up to Oldham and Hartley Counties. Amarillo, the largest city in the Canadian River Basin, has a total population of over 174,000 and is dissected by both the Red and Canadian River Basins. **Reach II** encompasses about a fourth of the northwestern portion of the city. The total population of the reach is approximately 120,000. The economics of the majority of the reach consists of agribusiness and oil and gas production. Amarillo is also home to a large refinery that produces copper, selenium, nickel, and tellurium. Also found only in this reach is the unique resource of free gaseous helium.



The reach contains 18 permitted municipal and industrial discharges, six permitted solid waste disposal sites, ten concentrated animal feeding operations, an estimated 5,000 septic tanks, and approximately 2,400 petroleum storage tanks. Also in this reach are four hazardous waste permits. There are more than 1,100 ground water wells in the reach using water from the Ogallala and Dockum Aquifers.

Reach II contains more than 600 farms and ranches covering an area of about 1.9 million acres of land. These farms and ranches produce principally cattle, wheat, oats, corn, sorghum, hay, barley, alfalfa, and soybeans. The majority of the area is irrigated farm land, with some dryland farming or pasture land for cattle.

Stream segments located in **Reach II** are:

0102	–	Lake Meredith
0102A	–	Big Blue Creek
0103	–	Canadian River above Lake Meredith
0103A	–	East Amarillo Creek
0103B	–	Punta de Agua Creek

During the reference period of September 1, 2003 through August 31, 2004, the Authority conducted eight monitoring events and collected 143 parameters from two water quality monitoring stations. The TCEQ conducted 12 monitoring events and collected 274 parameters from four water quality monitoring stations. In addition, the CRMWA conducted 24 monitoring events and collected 260 parameters from 16 water quality monitoring stations on Lake Meredith. **Figure 3** illustrates the monitoring coverage of **Reach II** for 2004.

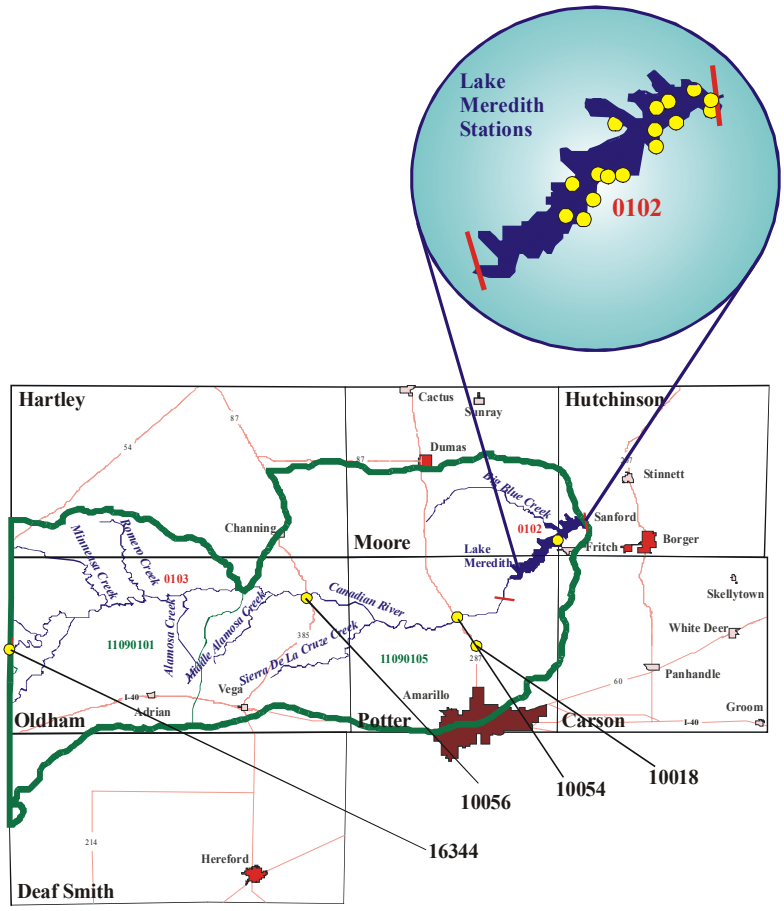


Figure 3

The largest reservoir in the Canadian River Basin is Lake Meredith with a total storage capacity of 1,407,600 acre-feet and a surface area of 21,640 acres at an elevation of 2,965 feet above mean sea level. Water is pumped from Lake Meredith to eleven area cities located within parts of the Canadian, Red, and Brazos River Basins.

The TCEQ's *Draft 2004 Texas Water Quality Inventory* lists Lake Meredith as fully supporting public water supply use criteria. However, it does reveal elevated levels of total dissolved solids, chloride, and sulfate. These elevated parameters are most likely due to inflow of high saline waters from the Canadian River into the lake. Data have determined that a major contributor of the saline water originates from a shallow brine aquifer under artesian pressure that filters into the river channel. In September 2001, the Canadian River Municipal Water Authority (CRMWA)

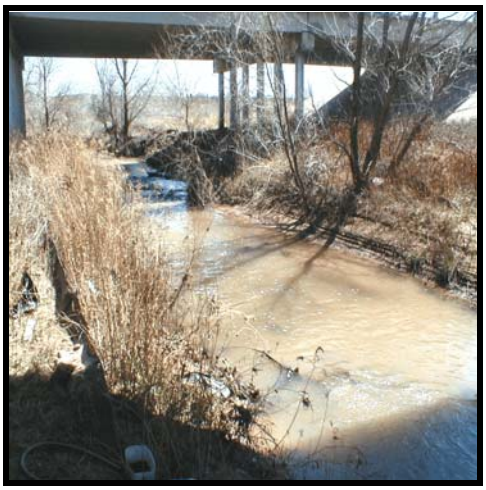
implemented the *Lake Meredith Salinity Control Project* which has greatly improved the salinity problem in the lake. Additional information on the project can be found on the CRMWA website at www.crmwa.com/lmscp2.htm.

Lake Meredith is also listed as on the TCEQ's *303(d) List of Impaired Water Bodies* for partially supporting its fish consumption use because of elevated mercury levels found in walleye. Mercury is a cumulative toxic compound that is known to accumulate in fish that are at the top of the food chain. Walleye is a large cool-water predator sport fish that predominates the food chain in Lake Meredith. Being a longer living creature, the walleye consumes contaminated prey species accumulating the methyl mercury in its tissues over time. Consumption of contaminated species like walleye may cause health problems in pregnant women, infants, and young children. The source of the mercury is questionable, however the Environmental Protection Agency (EPA) has speculated that such sources may come from the exhaust of refineries and coal fired power plants settling in water bodies. In addition, the EPA is currently considering implementing nationwide, intensive surveys on affected water bodies to scientifically ascertain the mercury sources.

The Canadian River above Lake Meredith is located from a point immediately upstream of the confluence of Camp Creek to the New Mexico state line. Overall, water quality in this segment is good with occasional exceedances of chloride and sulfate.

Also included in **Reach II** is East Amarillo Creek. It originates in northern Amarillo where the city has impounded the headwaters of the creek into a series of small impoundments collectively known as Thompson Park Lake. Storm water runoff and natural drainage in Amarillo supply the creek with flow. Overall water quality conditions in East Amarillo Creek are generally good. Occasional exceedances of bacteria and nutrients have been revealed. Since the creek receives runoff from the urban and rural areas of northern Amarillo, it is likely that this runoff may be the cause for the elevated parameters.

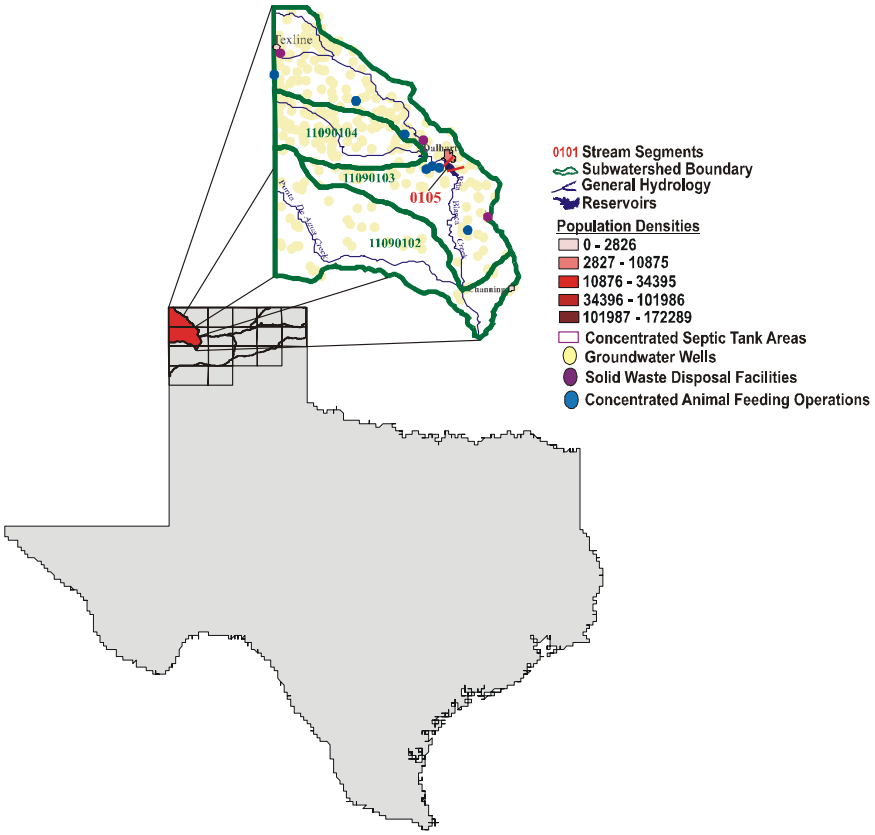
East Amarillo Creek
December 2003



East Amarillo Creek
March 2004

REACH III represents the Rita Blanca Creek watershed upstream to the Texas-New Mexico state line encompassing Hartley and Dallam Counties. The three subwatersheds contained in this reach includes approximately 3,600 square miles of which an estimated 1,500 square miles are contributing drainage.

Dalhart is the largest city in **Reach III** with a population of 7,200; more than 9,000 persons populate this reach. There are five other small towns including Texline and Channing. The economy of the reach is basically agribusiness, oil and gas production, and hunting. Rainfall averages from 16" to a little over 17" annually.



Within the reach are 16 concentrated animal feeding operation permits, one permitted solid waste disposal site, about 130 petroleum storage tanks, and approximately 2,500 septic tanks. More than 680 ground water wells use water from the Ogallala and Dockum Aquifers in **Reach III**.

There are more than 600 farms and ranches that cover more than 1.8 million acres of land. These farms and ranches produce cattle, wheat, oats, corn, sorghum, hay, barley, alfalfa, and soybeans. As described in the preceding reaches only a small portion is irrigated. The soils range from sandy alluvial soils to dark and reddish clay loams over flat plain to broken rocky valleys where the plains break into the Canadian River valley.

The only stream segment located in **Reach III** is:

0105 – Rita Blanca Lake

During the reference period of September 1, 2003 through August 31, 2004, the TCEQ conducted four monitoring events and collected 71 parameters from one water quality monitoring station on Rita Blanca Lake. **Figure 4** illustrates the monitoring coverage of **Reach III**.

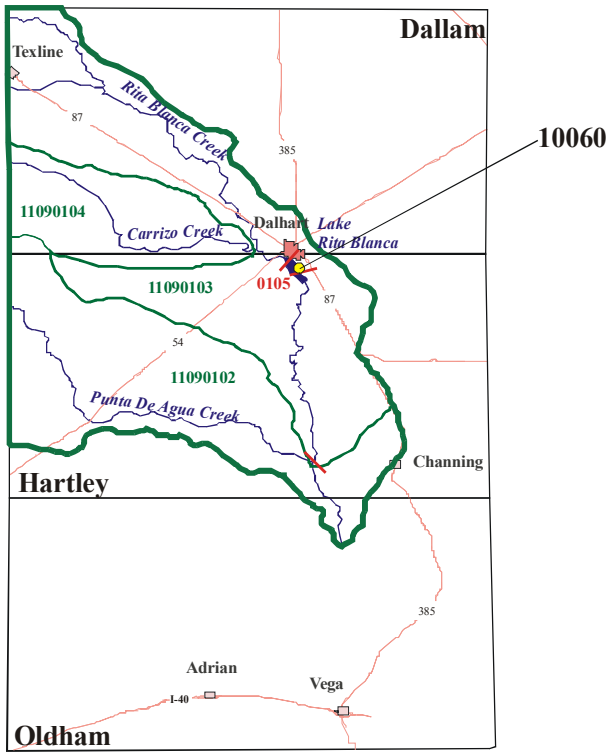


Figure 4

Rita Blanca Lake has a capacity of 12,100 acre-feet and a surface area of 524 acres at an elevation of 3,860 feet above mean sea level. The drainage area above the dam is 1,062 square miles, however, drought has almost dried up the lake. It was originally built in 1938 for flood control of the Rita Blanca Creek drainage area and by May 1941 it had filled to 75%. Since then, it has only filled to its capacity a couple of times.

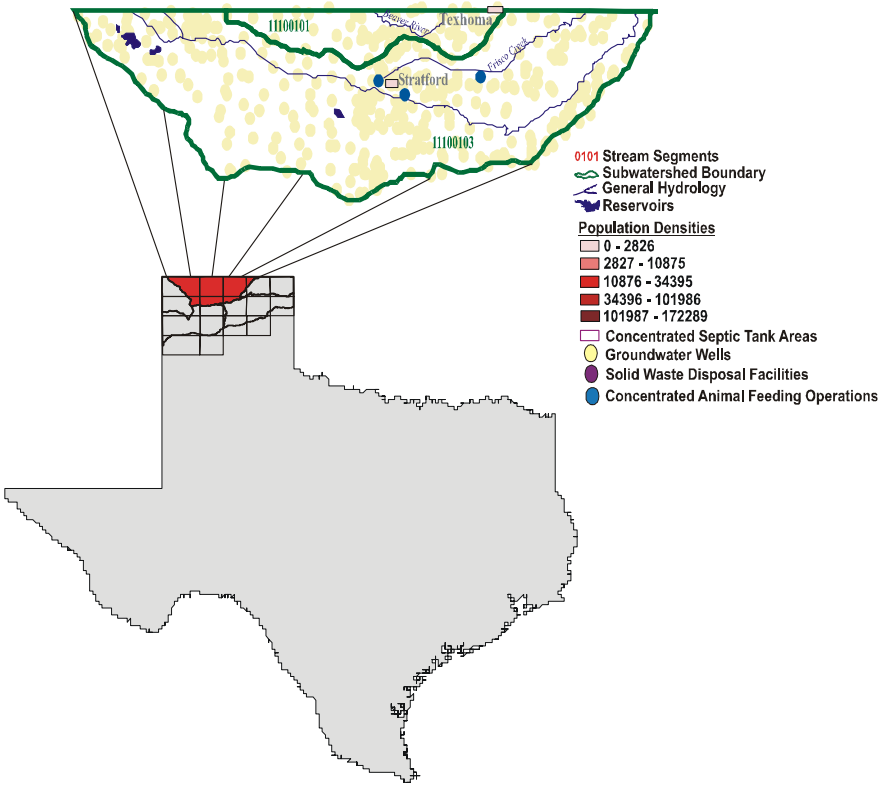
Rita Blanca Lake is unique in that it is the only segment in the Canadian River Basin to be classified as a *noncontact recreation* segment. Even with this categorization, Rita Blanca Lake is listed on the *Draft 2004 303(d) List* as not supporting the noncontact recreation use due to elevated levels of bacteria. Rita Blanca is also listed on the *2004 Draft Texas Water Quality Inventory* for general water quality use concerns for limited data on elevated total dissolved solids and pH levels.

The only inflow Rita Blanca Lake receives is treated effluent from the City of Dalhart wastewater treatment plant and from occasional rainfall. Without a steady inflow and only one source of water, Rita Blanca Lake is now a shallow, marshy wetland.

The Texas Parks and Wildlife Department has designated Rita Blanca Lake as a high quality water fowl habitat since it is located in the flyway of migratory waterfowl. These waterfowl cause an unusual, heavy organic load to Rita Blanca Lake, which results in the elevated total dissolved solids and pH levels. Consequently, the local residents do not consider the lake for recreational use.

REACH IV includes Palo Duro Creek from the northern Texas-Oklahoma state line upstream to its headwaters and portions of Coldwater Creek, Frisco Creek, and Lower Beaver River. It contains three subwatersheds with 6,500 square miles of which 3,500 are contributing drainage in Texas.

Major cities located in **Reach IV** include Dumas, Spearman, Cactus, Stratford, Sunray, and Gruver. Rainfall averages from 19" to 20" annually. More than 580 farms and ranches encompassing 1.1 million acres of land produce cattle, wheat, oats, corn, sorghum, hay, barley, alfalfa and soybeans within **Reach IV**. The soils range from sandy alluvial soils to dark and reddish clay loams over flat plain to broken rocky valleys.



There are four permitted municipal and industrial dischargers, eight permitted solid waste disposal sites, about 26 concentrated animal feeding operations, around 530 petroleum storage tanks, and approximately 1,000 septic tanks. In addition, **Reach IV** includes more than 780 ground water wells that utilize water from the Ogallala and Dockum Aquifers.

The only stream segment located in **Reach IV** is:

0199 – Palo Duro Reservoir

Construction of Palo Duro Reservoir, by the Counties of Hansford and Moore and the City of Stinnett, was completed March 1991. The lake is located 10 miles North of Spearman.

Palo Duro Reservoir has a total storage capacity of 60,900 ac/ft with a drainage area of about 614 square miles. Total surface acres are 2,413 with an approximate shore line of 48 miles. Drainage area of the lake is 614 square miles, however the recent drought conditions combined with the natural arid nature of this region has slowed the filling of Palo Duro Reservoir.

During the reference period of September 1, 2003 through August 31, 2004, the TCEQ conducted two monitoring events and collected 53 parameters from one water quality monitoring station on Palo Duro Reservoir. In addition, the TCEQ performed 24-hour dissolved oxygen sampling at the same site on the reservoir. Refer to **Figure 5** for monitoring coverage of **Reach IV**.

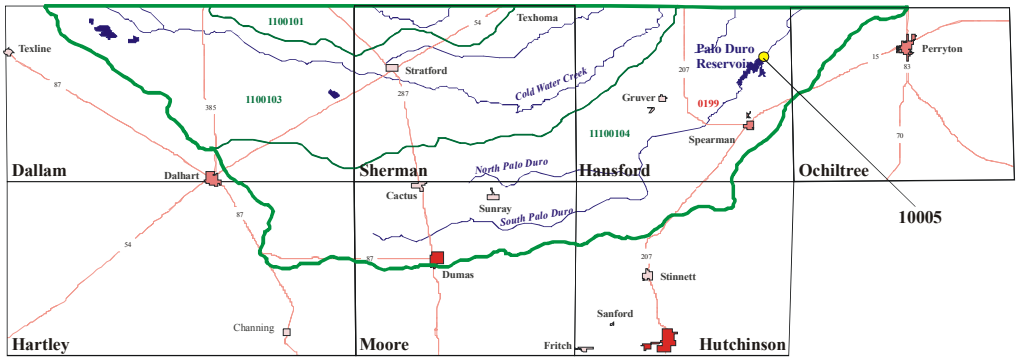
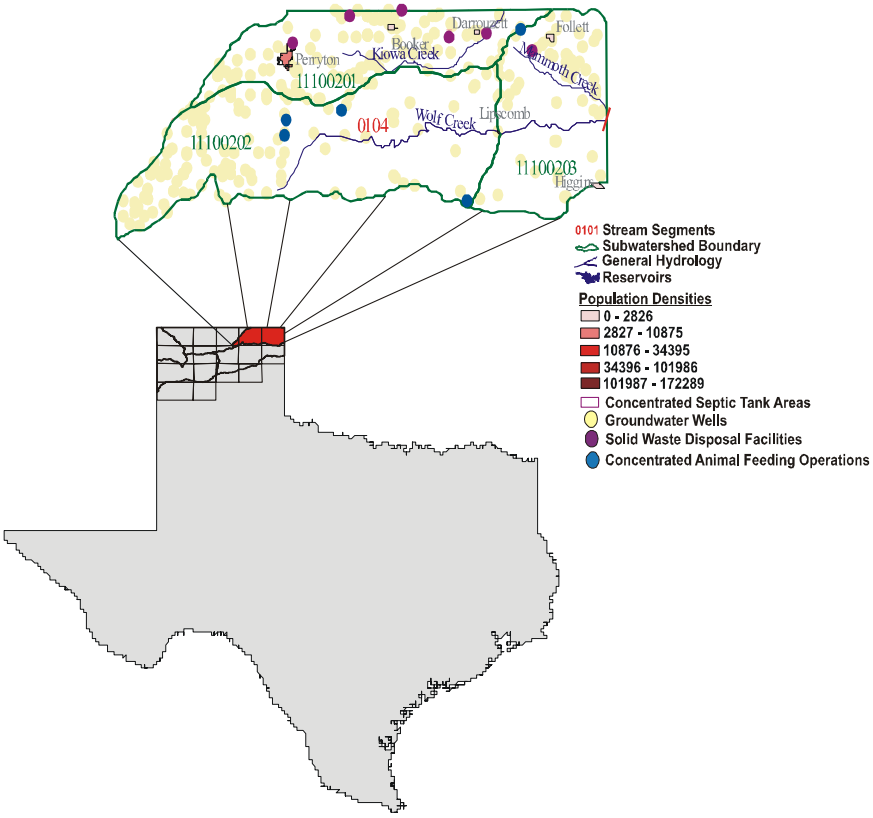


Figure 5

Palo Duro Reservoir was originally listed on the *2000 303(d) List* for the partial support of aquatic life use due to depressed dissolved oxygen. When it was assessed in 2002, an insufficient number of 24-hour dissolved oxygen values were available for proper analysis, but elevated ammonia and excessive algal growth were displayed. Although it was not assessed by the TCEQ in 2004, Palo Duro Reservoir will remain on the *Draft 2004 Texas Water Quality Inventory and 303(d) List* until a sufficient number of 24-hour dissolved oxygen measurements are available to demonstrate its support of the aquatic life use criteria.

REACH V comprises the Wolf, Mammoth, and Kiowa Creek watersheds from the Texas-Oklahoma state line upstream to the headwaters of each. It encompasses the upper eastern section of the Panhandle in Lipscomb and Ochiltree Counties, The largest city in **Reach V** is Perryton, which has a population of 7,800. Other towns include Booker, Higgins, Follett, and Darrouzett. The total population of the reach is approximately 11,000. Economics of the area are based on agribusiness, oil and gas production, and hunting. More than 660 farms and ranches encompass about 1.2 million acres of land that produces cattle, wheat, oats, corn, sorghum, hay, and barley.



There are ten permitted municipal and industrial dischargers, six permitted solid waste disposal sites, ten concentrated animal feeding operations, about 380 petroleum storage tanks, and approximately 1,300 septic tanks. In addition, more than 375 ground water wells within the reach utilize water from the Ogallala Aquifer.

The only stream segment located in **Reach V** is:

0104 – Wolf Creek

Wolf Creek is naturally spring-fed, therefore it flows year round. Local ranchers utilize Wolf Creek as a valuable watering source for their livestock. Consequently, runoff from rainfall events causes the bacterial levels to rise sharply, then decrease during drier periods.

During the reference period of September 1, 2003 through August 31, 2004, the Authority conducted 12 monitoring events and collected 338 parameters from three water quality monitoring stations on Wolf Creek. The TCEQ conducted two monitoring events and collected 80 parameters from one water quality monitoring station at Lake Fryer. Refer to **Figure 6** for an illustration of the monitoring coverage for **Reach V**.

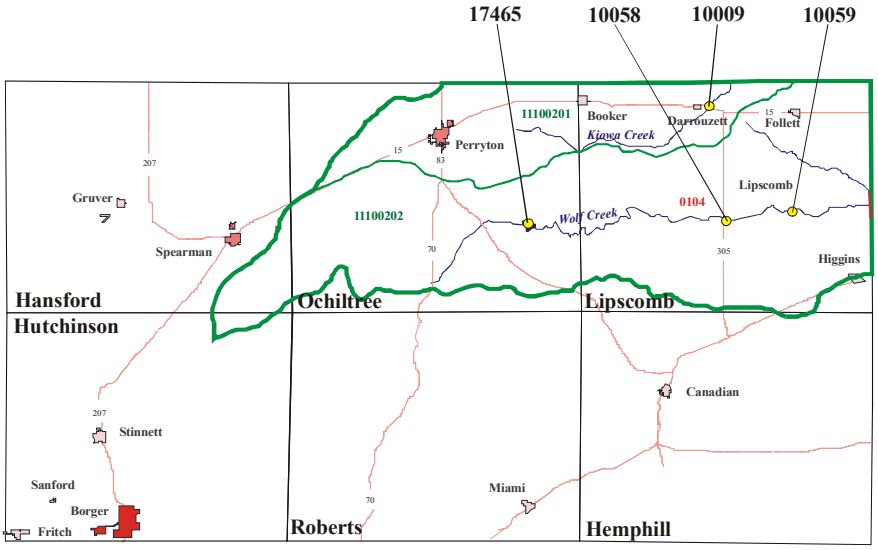


Figure 6

According to the TCEQ's *Draft 2004 Texas Water Quality Inventory*, **Reach V** of the Canadian River Basin is currently meeting all of its water body use criteria. The sites monitored by the Authority are located on Wolf Creek and no water quality issues are evident at this time.

Since monitoring began in 2002 on Lake Fryer, limited data were available to assess any water quality parameters from this water body.

Natural springs that provide water in Wolf Creek keep the water clarity good in this segment.

PUBLIC PARTICIPATION AND OUTREACH

One of the most successful components of the Clean Rivers Program is public participation. This enables the general public to broaden their awareness of water quality conditions, share knowledge and expertise of many, and cooperatively pursue avenues to rectify problems. The reflection of service with an emphasis on good science is fundamental to the Authority's purpose.

STEERING COMMITTEE

Originally conceived as a grass-roots project, the Clean Rivers Program established a way for the citizens of Texas to participate in effective statewide watershed planning activities. Each Clean Rivers Program partner developed a steering committee to set priorities within its own individual basin. These committees bring together diverse interests within each basin and watershed. Steering committee participants include representatives from the public, municipal, county, state, and federal government, industry, business, agriculture, environmental, education, civic organizations, and others.

As one of the most successful components of the Clean Rivers Program within the Canadian River Basin, the Steering Committee guided the program during these past years. The Authority has placed a significant amount of importance on public participation and outreach. This public forum enables the people of the basin to broaden their awareness of water quality conditions, share their knowledge and experience with others, and work together to solve issues within our area.

The Steering Committee and Basin Advisory Committee are one and the same. When originally formed, the Steering Committee was created to meet together when it may not have been possible for the entire Basin Advisory Committee to meet. However, through the years, the two committees have evolved into one, which serves its purpose very well.

Basin Advisory Committee Meetings are held at least once per year and are set up to be open, friendly, casual, and informative. They are designed to provide in-depth technical information regarding project work plans, monitoring schedules, reports, and any other relevant topics. Committee members are encouraged to ask questions and present their ideas. Members are also encouraged to bring guests.

VOLUNTEER ENVIRONMENTAL MONITORING

The Texas Rivers Project, in its 13th year, provides an opportunity for area students from junior high through high school to actively collect and analyze samples from their own unique monitoring sites. Over the last seven years, 12 schools have participated in the program. However, due to budget restrictions and time restraints, educators are not able to participate in the Texas Rivers Project as they have done in the past. The Authority is currently exploring ways to revitalize the program.

EARTH DAY

The Authority is proud to be associated with local Earth Day celebrations. Earth Day is celebrated in cooperation with River Bend Nature Works, an environmental educational center located in Wichita Falls that provides hands-on environmental programs to children and adults within a 100-mile radius. Last year's event was held April 14th and 15th with more than 750 area school children participating. The Authority's Environmental Services Division staff provided presentations on water quality and conservation to the students. Teachers were also provided with environmental educational materials for their students.

EDUCATION

Authority personnel also provide presentations to various organizations, clubs, and civic groups to spark interest and awareness in our local natural resource issues. Additionally, the Authority provides all types of information and articles that appear regularly in newspapers throughout the basin.

Another program sponsored by the Authority is the distribution of educational materials. The *Major Rivers* and *Think Earth* curricula are provided to area schools upon request, as much as funds allow. These two publications are favored by teachers and students alike. Last year approximately 40 packets were provided to area schools in the Red and Canadian River Basins.

RED RIVER AUTHORITY OF TEXAS WEBSITE

The Authority maintains a compelling commitment to provide up-to-date scientifically correct information on the website at www.rra.dst.tx.us. The website provides a virtual on-line encyclopedia of information and resources. The home page allows the user to locate information about the Authority and historically research the Canadian River Basin, and much more.

A popular feature on the Authority's website is the *Public Information Repository*. It guides one to a wealth of information. Facts and data on almost any aspect of the Canadian River Basin are just a few clicks away. Other information available include: data inventories, digital mapping, general information, legislation, environmental sites, historical weather data, and much more. The Authority also maintains an online publication library that includes reports and studies prepared by the Authority. Over the last few years, the Authority's web site has become very popular and is currently used by more than 3,500 visitors per day.

SUGGESTIONS FOR FUTURE WORK IN THE CANADIAN RIVER BASIN

As a Clean Rivers Program Partner, the Authority continues to monitor sites, analyze the data collected, determine trends, and assist in the development of Best Management Practices to maintain and/or improve the water quality in the Canadian River Basin.

The Clean Rivers Program has not received an increase in its program fees since its beginning in 1991. With rising costs for services and supplies throughout the state, monetary restrictions have been implemented. This has forced Clean Rivers Program partners to reduce sampling events and parameters collected. Since the number of monitoring sites and parameters needed to meet the Clean Rivers Program goals are far more than that actually sampled, an increase of continuous monitoring stations should be implemented to provide a constant, reliable source of water quality data. In addition, stream segments associated with the greatest risks of not attaining its water quality standards should receive the highest precedence.

With the United States under threat of terrorist attacks, precautionary measures should be in place to protect all water sources. Continuous monitoring upstream of the municipal water sources should be the highest priority during these times.

As an agency of the state, and in compliance with its mission, the Authority provides financial assistance as much as possible to alleviate some of the budget shortfalls, and also contributes to the Clean Rivers Program by payment of the fees assessed to fund the program. The Authority supports itself through contractual agreements with governmental and non-governmental entities, limiting the additional funding required to adequately monitor the basin's many water resources. Nevertheless, the Authority will continue to work toward full attainment of the Clean Rivers Program goals.

The Authority receives its guidance from the TCEQ, but also listens and responds to the needs provided and directed by the Basin Advisory Committee. The ideal situation would be a much more balanced approach to all needs of the basin.

BECOME INVOLVED

Active involvement is vital in the watershed management in the Canadian River Basin for the Clean Rivers Program. There are many ways to become involved in the planning of the basin's water quality and environmental health. For information on becoming involved in the Basin Advisory Committee or other public outreach activities, please contact the Authority or refer to the Authority's website at www.rra.dst.tx.us.