REGION B

REGIONAL WATER PLAN

Prepared for

Region B Water Planning Group

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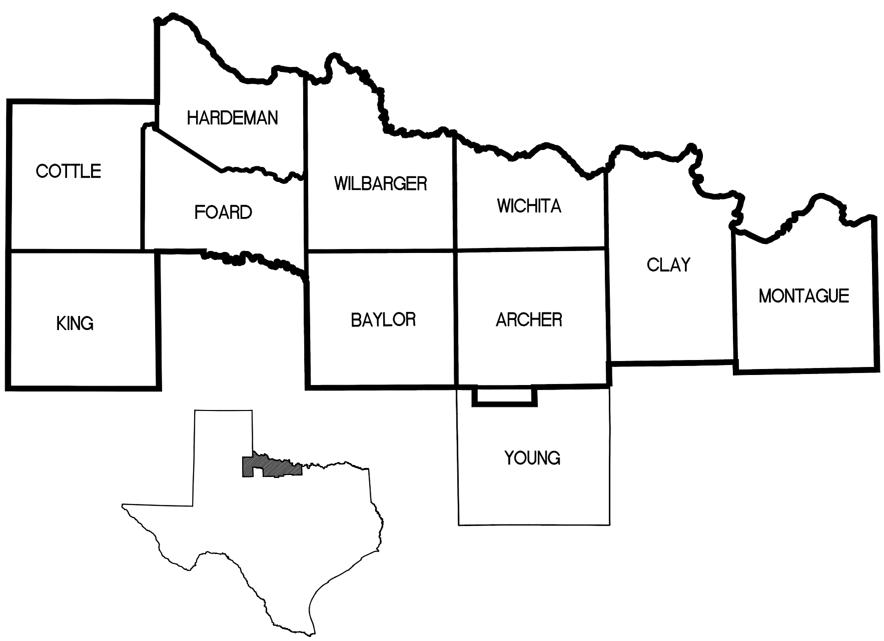

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Partial List of Acronyms

Acronym	Name	Meaning
DFC	Desired Future Condition	Criteria for which is used to define the amount of available groundwater from an aquifer.
GAM	Groundwater Availability Model	Numerical groundwater flow model. GAMs are used to determine the aquifer response to pumping scenarios. These are the preferred models to assess groundwater availability.
GCD	Groundwater Conservation District	Generic term for all or individual state recognized Districts that oversee the groundwater resources within a specified political boundary.
GMA	Groundwater Management Area	Sixteen GMAs in Texas. Tasked by the Legislature to define the desired future conditions for major and minor aquifers within the GMA.
MAG	Managed Available Groundwater	The MAG is the amount of groundwater that can be permitted by a GCD on an annual basis. It is determined by the TWDB based on the DFC approved by the GMA. Once the MAG is established, this value must be used as the available groundwater in regional water planning.
MGD	Million Gallons per Day	Measurement of rate of use. Typically used when sizing infrastructure.
gpm	Gallons per minute	Measurement of rate. Typically used to describe a diversion rate or capacity of water wells.
RWPG	Regional Water Planning Group	The generic term for the planning groups that oversee the regional water plan development in each respective region in the State of Texas
SB1	Senate Bill One	Legislation passed by the 75th Texas Legislature that is the basis for the current regional water planning process.
SB2	Senate Bill 2	Legislation passed by the 77th Texas Legislature that built on policies created in SB1.
TCEQ	Texas Commission on Environmental Quality	Texas Agency charged with oversight of Texas surface water rights and WAM program.
TWDB	Texas Water Development Board	Texas Agency charged with oversight of regional water plan development and oversight of GCDs
WAM	Water Availability Model	Computer model of a river watershed that evaluates surface water availability based on Texas water rights.
WCWID #2	Wichita County Water Improvement District #2	Entity responsible for operating the Lake Kemp and Diversion system for irrigation use.
WMS	Water Management Strategy	Strategies available to RWPG to meet water needs identified in the regional water plan.

REGION B REGIONAL WATER PLAN
Partial List of Acronyms

Acronym	Name	Meaning
WUG	Water User Group	A group that uses water. Six major types of WUGs: municipal, manufacturing, mining, steam electric power, irrigation and livestock.
WWP	Wholesale Water Provider	Entity that has or is expected to have contracts to sell 1,000 ac-ft/yr or more of wholesale water.

EXECUTIVE SUMMARY

TEXAS STATE WATER PLAN

REGION B

SEPTEMBER 2010

EXECUTIVE SUMMARY
TEXAS STATE WATER PLAN
REGION B

Introduction

Senate Bill 1 of the 75th Texas Legislature was passed in 1997 to set the process of developing a comprehensive state water plan. To accomplish this task, the state was divided into 16 regional water planning groups. This report describes Region B as designated by Senate Bill 1. Region B is comprised of ten entire counties and a portion of one county in north central Texas. Specifically, those counties are Archer, Baylor, Clay, Cottle, Foard, Hardeman, King, Montague, Wichita, Wilbarger, and the City of Olney in Young County. Figure 1 shows the region, cities, towns, and the counties it encompasses.

Description of Region B

Region B lies mainly in the Red River Basin, however, southern portions of Archer, Clay, and Montague Counties lie in the Trinity River Basin, and southern portions of Archer, Baylor, and King Counties lie in the Brazos River Basin.

In 2000, the total population of the region was reported to be 201,970, with the largest population center, the City of Wichita Falls, being 104,197 or 52 percent of the total. The second largest city was Vernon with a population of 11,660.

In general, most of the population is concentrated in eastern portions of the region with over one-half located in and around Wichita Falls. The January 1, 2000 estimated population density of the region ranged from a high of 210 persons per square mile (Wichita County) to a low of less than one person per square mile (King County). Regional population is forecasted to increase by approximately 10 percent over the study period. Table ES-1 shows the 1990 census population by county and the corresponding census population in 2000.

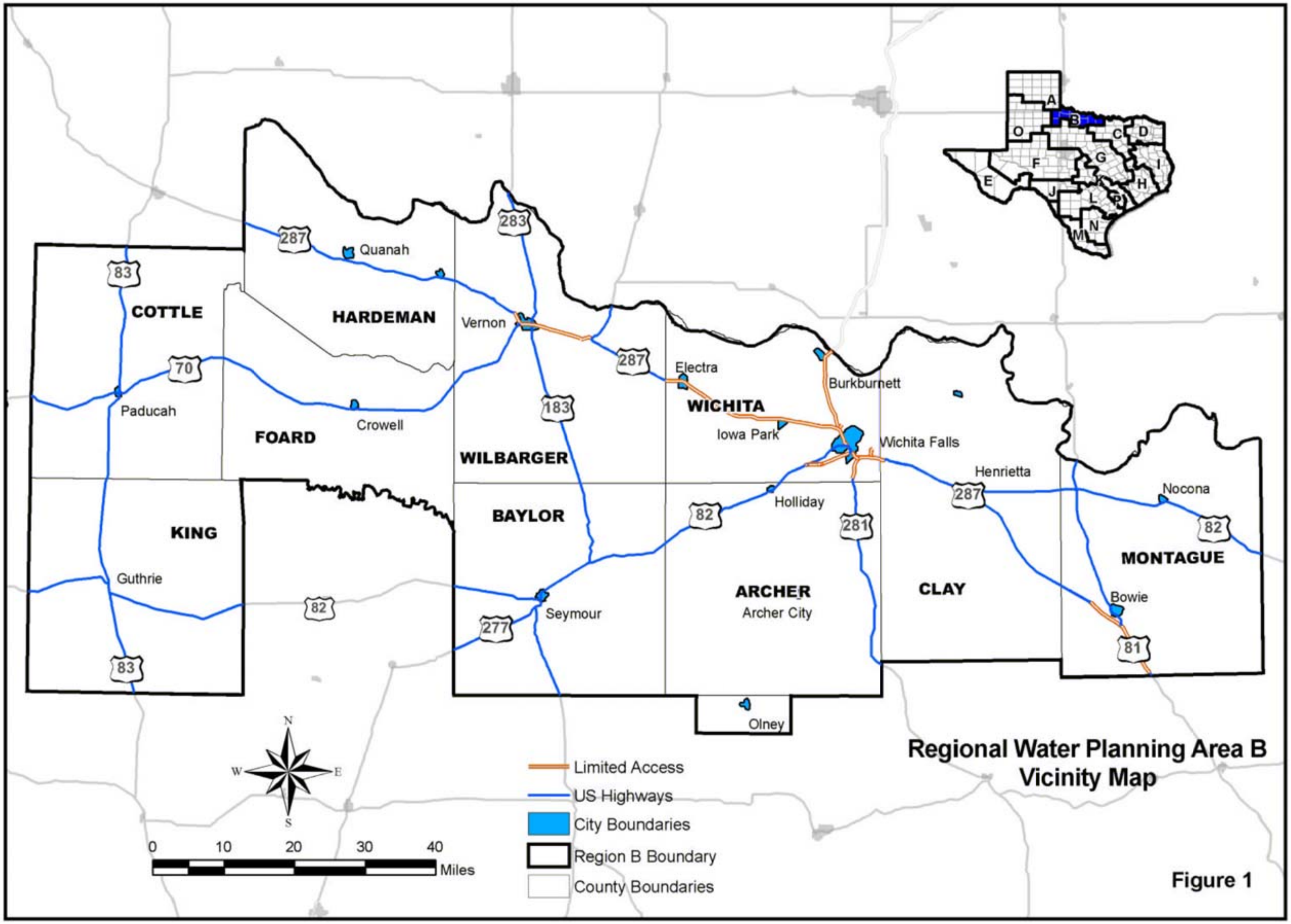

Regional Water Planning Area B
Vicinity Map
Figure 1
COTTLE
KING
HARDEMAN
FOARD
WILBARGER
BAYLOR
WICHITA
ARCHER
CLAY
MONTAGUE
Quanah
Vernon
Paducah
Crowell
Guthrie
Seymour
Electra
Iowa Park
Burkburnett
Wichita Falls
Holliday
Archer City
Olney
Henrietta
Nocona
Bowie
Limited Access
US Highways
City Boundaries
Region B Boundary
County Boundaries
0
10
20
30
40
Miles
N
S
E
W

Table ES-1:
County Populations

County	Area (sq. mi)	1990 Population	2000 Population	% Change	Density people/sq.mi.
Archer	910	7,973	8,854	11.0%	10
Baylor	871	4,385	4,093	-6.7%	5
Clay	1,098	10,024	11,006	9.8%	10
Cottle	901	2,247	1,904	-15.3%	2
Foard	707	1,794	1,622	-9.6%	2
Hardeman	695	5,283	4,724	-10.6%	7
King	912	354	356	0.6%	< 1
Montague	931	17,274	19,117	10.7%	21
Wichita	628	122,378	131,664	7.6%	210
Wilbarger	971	15,121	14,676	-2.9%	15
Young	2	3,519	3,396	-3.5%	1617
Average	784	17,305	18,310	5.8%	23

The City of Wichita Falls is the largest water demand center in the region. Other demand centers include Seymour, Henrietta, Quanah, Bowie, Nocona, Burkburnett, Electra, Iowa Park, Vernon, Olney, and Archer City. Table ES-2 below shows the population, water use, and gallons per capita per day (GPCD) usage for each center.

Table ES-2:
Regional Demand Centers

County	City	2000 Population	2000 Municipal Water Use (Ac-Ft)	Water Use (GPCD)
Archer	Archer City	1,848	232	112
Baylor	Seymour	2,908	554	170
Clay	Henrietta	3,264	526	144
Hardeman	Quanah	3,022	565	167
Montague	Bowie	5,219	824	141
Montague	Nocona	3,198	484	135
Wichita	Burkburnett	10,927	1,273	104
Wichita	Electra	3,168	337	95
Wichita	Iowa Park	6,431	1,232	171
Wichita	Wichita Falls	104,197	21,942	188
Wilbarger	Vernon	11,660	2,795	214
Young	Olney	3,396	609	160

While the population of Region B is only expected to reach near 222,000 by 2060, the Dallas-Fort Worth Metroplex, located just east of the region, is expected to top 9 million. This population could likely impose increasing pressures on water based recreational resources of the

Region, as the number of people willing to travel into Region B for recreational purposes increases.

Population and Water Use Projections

The population projections for Region B were determined by the following:

- Using the latest information published by the State Data Center for city populations;
- Surveying the cities, smaller communities, rural water supply corporations, municipal utility districts, and river authorities to determine population based on existing meter counts;
- Using growth trends derived from the surveys based on populations and meter counts from 1990 to 2000.

Table ES-3 shows the population projections for each incorporated city by county and rural areas outside of any incorporated entity (Other Rural).

Table ES-3
Population Projections

CITY	COUNTY	RIVER BASIN	1990 POP.	2000 POP.	2010 POP.	2020 POP.	2030 POP.	2040 POP.	2050 POP.	2060 POP.
Archer City	Archer	RED	1,784	1,848	2,022	2,200	2,345	2,390	2,307	2,223
Holliday	Archer	RED	1,475	1,632	1,786	1,943	2,071	2,110	2,038	1,963
Lakeside City	Archer	RED	865	984	1,077	1,172	1,249	1,272	1,228	1,183
Seymour	Baylor	BRAZOS	3,185	2,908	2,692	2,569	2,378	2,206	2,089	1,933
Byers	Clay	RED	510	517	534	550	546	524	491	459
Henrietta	Clay	RED	2,896	3,264	3,374	3,470	3,448	3,306	3,103	2,900
Petrolia	Clay	RED	762	782	808	831	826	792	743	695
Paducah	Cottle	RED	1,788	1,498	1,458	1,455	1,384	1,304	1,233	1,193
Crowell	Foard	RED	1,230	1,141	1,137	1,145	1,121	1,081	1,055	1,017
Chillicothe	Hardeman	RED	816	798	796	795	791	786	780	769
Quanah	Hardeman	RED	3,413	3,022	2,981	2,954	2,863	2,746	2,617	2,371
Guthrie	King	RED	150	150	152	144	124	98	77	75
Bowie	Montague	TRINITY	4,990	5,219	5,305	5,389	5,423	5,436	5,440	5,449
Montague	Montague	RED	490	479	470	460	440	421	401	395
Nocona	Montague	RED	2,870	3,198	3,321	3,442	3,491	3,510	3,515	3,528
Saint Jo	Montague	TRINITY	1,048	898	898	898	898	898	898	898
Burkburnett	Wichita	RED	10,145	10,927	11,465	11,949	12,269	12,436	12,553	12,647
Electra	Wichita	RED	3,113	3,168	3,206	3,240	3,263	3,275	3,283	3,290
Iowa Park	Wichita	RED	6,072	6,431	6,678	6,900	7,047	7,124	7,178	7,221
Wichita Falls	Wichita	RED	96,259	104,197	109,663	114,576	117,825	119,525	120,710	121,668
Vernon	Wilbarger	RED	12,001	11,660	12,139	12,655	12,706	12,451	11,844	11,144
Olney	Young	BRAZOS	3,519	3,396	3,429	3,504	3,509	3,469	3,418	3,386
Other Rural			31,514	33,853	35,251	36,677	37,234	37,005	36,214	35,327
Total			**190,895**	**201,970**	**210,642**	**218,918**	**223,251**	**224,165**	**223,215**	**221,734**

The water use for Region B has been divided into several categories for analysis purposes. The various uses analyzed include water for municipal use (MUN), industrial or manufacturing (MFG), power plant cooling (PWR), mining (MIN), agricultural irrigation (IRR), and livestock watering (STK). Table ES-4 shows the amounts of water predicted to be required for these categories through the year 2060. The water use is shown in acre-feet (Ac-Ft) units with one acre-foot being equivalent to 325,851 gallons of water.

Table ES-4
Projected Water Use (Acre-Feet)

YEAR	2000	2010	2020	2030	2040	2050	2060
MFG	3,162	3,547	3,755	3,968	4,260	4,524	4,524
PWR	9,841	13,360	17,360	21,360	21,360	21,360	21,360
MIN	1,190	909	845	811	785	792	792
IRR	66,504	99,895	97,702	95,537	93,400	91,292	91,292
STK	10,464	12,489	12,489	12,489	12,489	12,489	12,489
MUN	37,422	40,964	39,655	40,196	39,664	38,962	38,696
TOTAL	128,583	171,164	171,806	174,361	171,958	169,419	169,153

Total water consumption for the region is predicted to remain approximately level from 2000 to 2060.

Evaluation of Current Water Supplies

Water users in the Region B planning area receive surface water from sources in the Brazos, Trinity, and Red River Basins. In addition, groundwater is primarily supplied in Region B by two aquifers, the Seymour and the Blaine.

The Seymour is designated a major aquifer and is found in the central and western portions of the region. It is currently used in Hardeman, Wilbarger, Wichita, Clay, Baylor, Foard, and Cottle Counties. The Blaine is considered a minor aquifer and useable groundwater is limited to the westernmost portion of the region. These aquifers provide a large percentage of available supply in these counties. In addition, the upper portion of the Trinity Aquifer occurs in Montague County in the eastern part of the region. Limited quantities of groundwater are used from the Trinity for municipal and irrigation uses. There are also other formations within the region that are used for ground water supply in limited areas. The TWDB identifies these sources as “Undifferentiated Other Aquifer”. These formations are not well defined in the literature, but still provide substantial quantities of water in Archer, Clay, Cottle, Montague and Wichita Counties.

The total amount of firm supply currently available to Region B is approximately 376,000 acre-feet per year, as shown in Table ES-5. This represents firm supply available to the region.

However, the supply that is available to each user is less due to operational and contractual constraints, infrastructure limitations and water treatment capacities. A comparison of the regional firm supply to the current available supply for the water users is shown in Figure ES-1.

By 2060, the supply to Region B decreases by over 25,000 acre-feet per year. This is mostly the result of reduced storage capacities of existing reservoirs due to sediment accumulation.

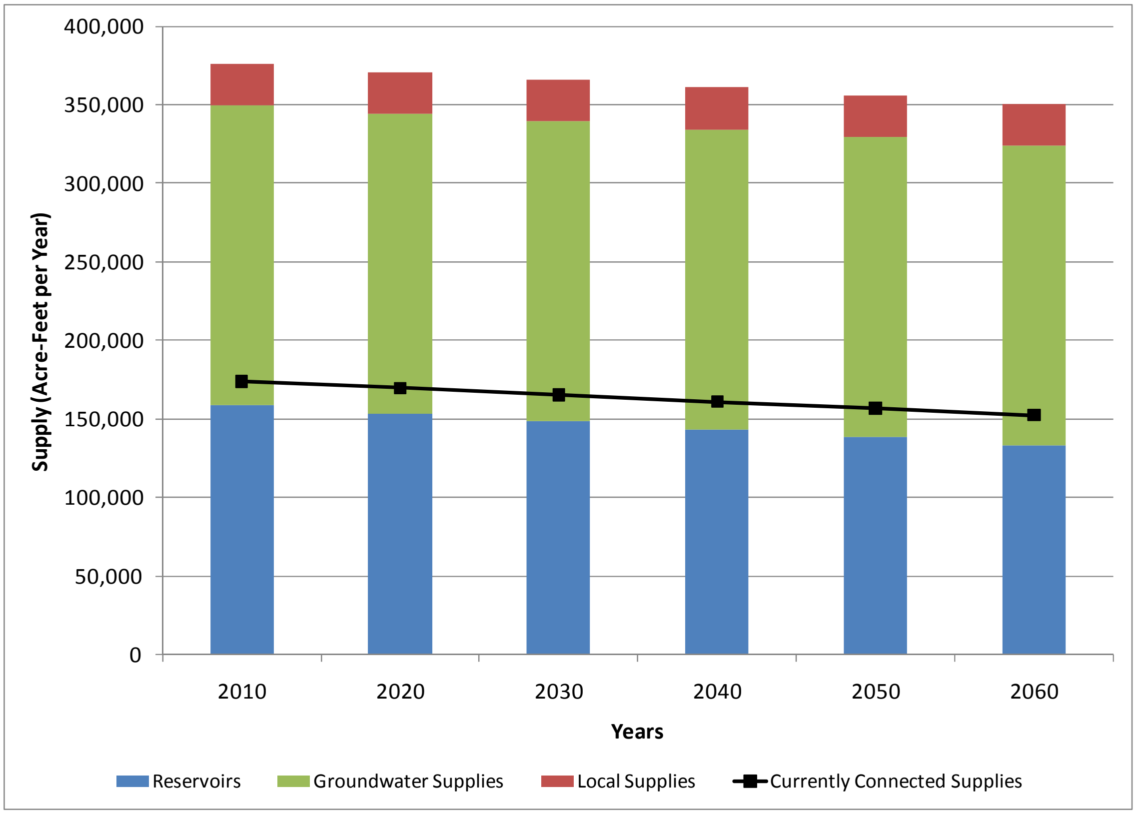
Table ES-5
Summary of Firm Supplies to Region B

	2000	2010	2020	2030	2040	2050	2060
Reservoirs in Region B	161,705	156,687	151,669	146,651	141,633	136,615	131,595
Reservoirs outside Region B[1]	1,778	1,778	1,746	1,737	1,710	1,701	1,641
Run-of-the-River Supplies	15,409	15,409	15,409	15,409	15,409	15,409	15,409
Local Supplies	9,018	11,316	11,316	11,316	11,316	11,316	11,316
Groundwater Supplies	190,817	190,817	190,817	190,817	190,817	190,817	190,817
Total	**378,727**	**376,007**	**370,957**	**365,930**	**360,885**	**355,858**	**350,778**

Notes: 1. The supply reported for reservoirs outside of Region B is only the amount of water that is supplied to water users in Region B.

Figure ES-1

Comparison of Firm Supplies to Supplies Available to Water Users



Identification, Evaluation and Selection of Water Management Strategies

A comparison of current supply to demand was performed using projected demands and the allocation of existing supplies developed as evaluated under drought of record conditions. Allocations of existing supplies were based on the most restrictive of current water rights, contracts and available yields for surface water, historical use, and groundwater availability. The allocation process did not directly address water quality issues such as nitrates. Salinity was addressed to some extent by not assigning supplies with known high salinity levels for municipal use. This included most of the Blaine aquifer.

As a region, there is adequate supply to meet the region's needs until 2020. A small shortage begins by 2020, and increases to nearly 16,000 acre-feet per year by 2060. A comparison of the total regional supply to demand is shown in Figure ES-2

A summary of the projected needs by county are presented in Table ES-6. There are eight water user groups with identified shortages that cannot be met by existing infrastructure and supply. These shortages total 40,366 acre-feet per year by 2060. Of this amount, over 98 percent of the shortage is associated with reduced supplies in the Lake Kemp and Diversion system. Table ES-7 lists the water user groups with projected water shortages.

Figure ES-2
Supply and Demand for Region B

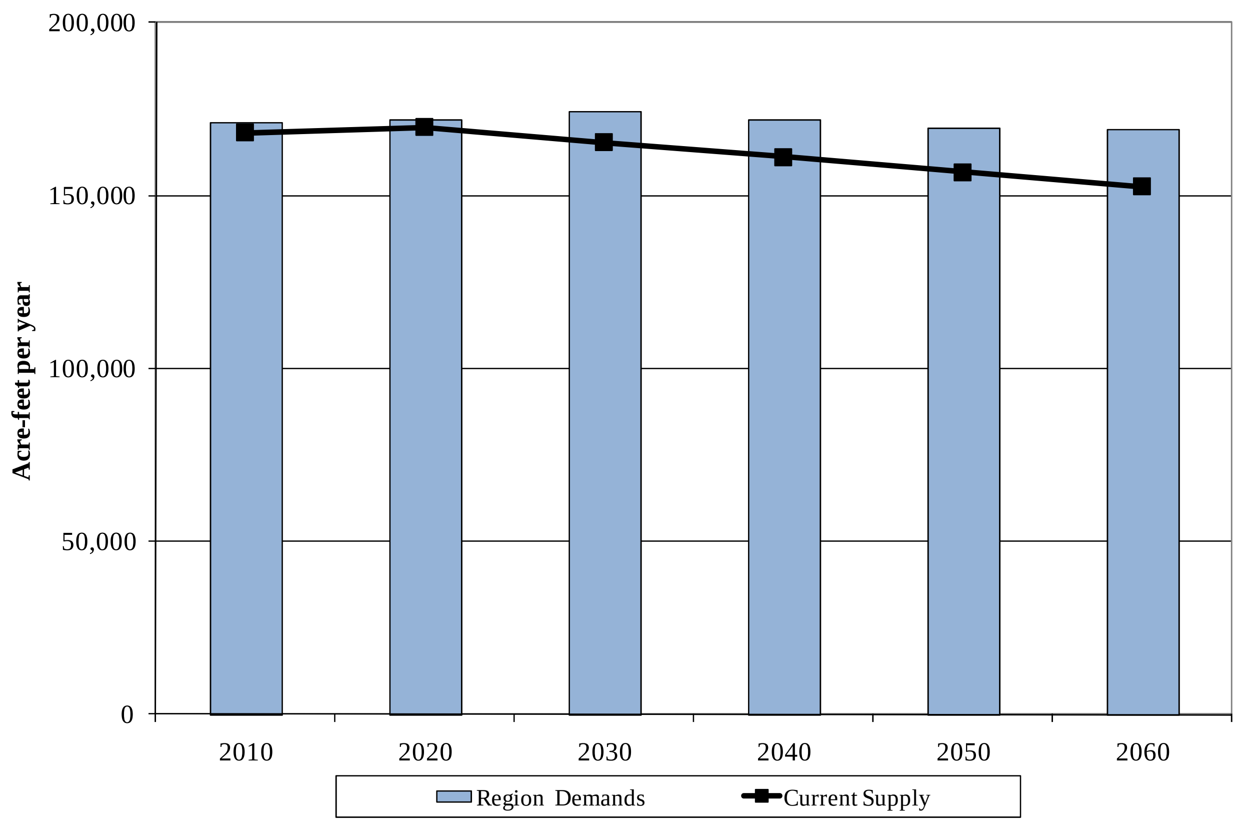


Table ES-6

Comparison of Supply and Demand by County

County	2010	2020	2030	2040	2050	2060
Archer	-499	-534	-620	-677	-655	-754
Baylor	1,905	2,011	2,115	2,187	2,238	2,284
Clay	318	401	482	646	904	994
Cottle	684	832	980	1,126	1,262	1,271
Foard	546	691	833	975	1,111	1,117
Hardeman	1,139	1,292	1,448	1,594	1,736	1,745
King	377	368	373	387	394	400
Montague	547	486	441	377	327	251
Wichita	-12,207	-13,464	-16,575	-18,842	-21,098	-24,567
Wilbarger	9,734	5,509	1,288	1,088	909	349
Young (P)	254	276	294	314	330	336
Region	**2,798**	**-2,132**	**-8,941**	**-10,825**	**-12,543**	**-16,575**

Table ES-7

Projected Water Shortages for Water User Groups

Water User Group	2010	2020	2030	2040	2050	2060
County-Other - Archer	-162	-126	-161	-187	-142	-136
Irrigation - Archer	-1,301	-1,344	-1,386	-1,426	-1,465	-1,584
County-Other - Clay	-45	-25	-8	0	0	0
Irrigation - Clay	-349	-331	-309	-284	-253	-274
County-Other - Montague	-224	-280	-295	-304	-290	-295
Mining - Montague	-177	-153	-145	-149	-162	-162
Irrigation - Wichita	-21,296	-22,252	-23,215	-24,184	-25,159	-27,201
Steam Electric Power - Wilbarger	0	-3,800	-8,529	-9,258	-9,987	-10-715
TOTAL	**-23,554**	**-28,311**	**-34,047**	**-35,792**	**-37,458**	**-40,366**

While many water user groups were not identified with a shortage, several were found to have little to no supplies above the projected demands. The Region B Regional Water Planning Group recognized that these entities were likely to need to develop new supplies to provide a safe level of water supply. To determine which entities may be impacted, a safe supply was defined as being able to meet the projected demands plus 20 percent of the demand. This was applied only to municipal and manufacturing water user groups. Using these criteria, eight water users were identified with safe supply shortages as shown in Table ES-8.

Table ES-8

Water Users with Safe Supply Shortages

	2010	2020	2030	2040	2050	2060
County-Other - Archer	-269	-223	-265	-296	-242	-235
Lakeside City	-3	0	-12	-7	0	0
County-Other - Clay	-223	-199	-179	-79	0	0
County-Other - Montague	-485	-554	-572	-584	-567	-572
Iowa Park - Wichita	-229	-204	-202	-202	-202	-211
Wichita Falls - Wichita	0	0	-181	-1,467	-2,745	-4,204
Manufacturing – Wichita	-357	-383	-409	-439	-462	-462
Bowie - Montague	0	0	0	-50	-103	-171

The City of Wichita Falls is the only wholesale water provider in Region B and is a regional provider for much of the water in Wichita, Archer and Clay counties. Considering current customer contracts and city demands, Wichita Falls has sufficient supplies to meet the projected firm needs and existing contractual obligations. The City has a projected shortage of 4,875 acre-feet per year to meet safe supply needs. This includes providing for the safe supply shortages shown for Iowa Park and Wichita County Manufacturing. A summary of the supply and demand comparison for Wichita Falls is shown in Table ES-9.

Table ES-9

Projected Water Shortages for the City of Wichita Falls

	2010	2020	2030	2040	2050	2060
Total Current Customer Demand	38,735	37,593	38,642	38,669	38,686	38,882
Total Supplies	40,981	39,721	38,462	37,202	35,942	34,679
Supplies Less Current Customer Demand	2,246	2,128	-180	-1,467	-2,744	-4,203
Potential Future Customer Demand	589	587	622	648	664	672
Supplies Less Current and Future Customer Demand	1,657	1,540	-802	-2,114	-3,407	-4,875

Water quality is a significant issue in Region B. Due to limited resources, some user groups are using water of impaired quality or having to install additional treatment systems to utilize existing sources. An implied assumption of the supply analysis is that the quality of existing water supplies is acceptable for the listed use. In other words, water supplies that are currently being used are assumed to continue to be available, regardless of the quality. Senate Bill 1 requires that water quality issues be considered when determining the availability of water during the planning period. For this report, evaluations of source water quality are generally confined to waters used for human consumption. The effect of water quality of Lake Kemp on agricultural use is also reviewed.

The Texas Commission on Environmental Quality (TCEQ) identifies systems that are not compliant with current and proposed primary drinking water standards. This list was reviewed for water users in Region B. Compliance with secondary drinking water standards was not evaluated since the secondary standards do not have the same regulatory and public health implications. Also, compliance with the bacteriological standards (total coliform and fecal coliform) was not evaluated since violations of these standards, when they occur, are typically associated with operational techniques and not the quality of the raw water supply. The water systems in Region B that have existing or potential non-compliances are identified in Table ES-10, along with the parameter of concern.

Table ES-10
Water Systems Not Compliant with Primary Drinking Water Quality Standards

Water System	County	Water Source	CURRENT STANDARD
			NO_3
			MCL = 10 mg/L
Charlie WSC	Clay	Seymour Aquifer	X
Lockett Water System	Wilbarger	Seymour Aquifer	X
Hinds-Wildcat Water System	Wilbarger	Seymour Aquifer	X

The TCEQ records indicate that the only primary drinking water standard (other than bacteriological) currently exceeded by water users in Region B is the nitrate criterion. Four water users have water supplies that exceed the MCL for nitrate.

In Region B, water supply needs were identified for three different categories: quantity, quality, and reliability. As shown on Table ES-11, a total of 17 water user groups were identified with one or more of these need categories. Eight water user groups were identified with firm quantity needs. An additional four water user groups have projected safe supply shortages, and four municipal suppliers were found to have water quality and reliability issues.

Table ES-11

Water Users with Identified Needs

		Water Supply Needs		
User	**County**	**Quantity**	**Quality**	**Reliability**
County Other	Archer	X		
Lakeside City	Archer	X		
Irrigation	Archer	X	X	
Baylor WSC	Baylor	X	X	X
County Other	Clay	X	X	
Charlie WSC	Clay		X	
Irrigation	Clay	X	X	
County Other	Montague	X		
Bowie	Montague	X		
Mining	Montague	X		
Irrigation	Wichita	X	X	
Iowa Park	Wichita	X		X
Manufacturing Wichita	Wichita	X		
Wichita Falls	Wichita	X		
Lockett Water System	Wilbarger	X	X	X
Hinds-Wildcat System	Wilbarger		X	X
Steam Electric Power	Wilbarger	X		

For each of the identified needs, the recommended strategies in the 2007 State Water Plan were reviewed for applicability and updated as needed. In accordance with regional water planning guidance, the potentially feasible strategies were then evaluated with respect to:

- Quantity, reliability, and cost
- Environmental factors
- Impacts on water resources and other water management strategies
- Impacts on agriculture and natural resources
- Other relevant factors.

As required by Senate Bill 2, water conservation must be considered when developing water management strategies for water user groups with needs. Generally water conservation was not included in the projected demands for non-municipal water uses in Region B. An expected level of conservation is included in the municipal demand projections due to the natural replacement of inefficient plumbing fixtures with low flow fixtures, as mandated under the State Plumbing Code. For Region B, the total municipal water savings associated with plumbing fixtures is approximately 14.3 percent of the projected demand if no conservation occurred.

Additional conservation savings can potentially be achieved in the region through the implementation of conservation best management practices. It is assumed that entities with low per capita water use will have minimal reductions in water use through conservation. In Region B there are seven municipal water user groups with identified safe supply shortages. Of these entities, Lakeside City and Montague County-Other have per capita water use below the screening criteria of 140 gallons per person per day. Municipal Conservation strategies, with the exception of passive strategies, will not be evaluated for these user groups.

Conservation strategies appropriate for Region B were evaluated based on the best management practices identified through the State Water Conservation Implementation Task Force. The Task Force identified 21 municipal conservation strategies and 15 strategies for industrial water users. In addition there are new Federal regulations that require new clothes washers to be water efficient by 2007, which may reduce water use. After review and consideration of these strategies, the recommended municipal conservation package consists of four management practices:

- Public and School Education
- Reduction of Unaccounted for Water through Water Audits
- Water Conservation Pricing
- Federal Clothes Washer Rules

Best management practices not selected include rebate programs, accelerated plumbing fixtures replacements, and specific outdoor watering measures. The benefits of outdoor watering strategies were assumed to be accounted under the public and school education practice. Also, many of the entities in Region B already use restrictions on outdoor watering as a drought management measure. Accelerated fixture replacements do not reduce the ultimate water need, but could delay when the need begins. In Region B, the largest municipal water user, Wichita Falls, has water needs beginning in 2030. No additional savings can be achieved through accelerated implementation of plumbing fixtures. This is also true for rebate programs that simply accelerate the already assumed conservation savings. The likelihood of implementing rebate programs in rural communities is low and previous studies have shown these programs to be relatively costly per acre-foot of water saved.

For the irrigation and steam electric power needs associated with shortages in Lake Kemp, conservation through reductions in transmission losses in the irrigation canal system will be considered.

A summary of the water savings projected from conservation measures is shown in Table ES-12 and the savings expressed as a percentage of the projected water demands are shown in Table ES-13. Strategies that are required by federal (clothes washer rules) or state (water audits) regulations were assumed to be implemented in accordance with these regulations. Other conservation practices were assumed to be implemented in the decade the entity was found to have a water shortage.

Most of the savings shown in Table ES-12 are associated with the passive clothes washer rules that will require all new clothes washers to be energy efficient. This strategy assumes that every household that purchases a new clothes washer will reduce its water use by 5.6 gallon per person per day at no additional cost to the water provider; however, it is uncertain as to whether this amount of savings will be realized by the respective entity.

Table ES-12
Total Water Savings Associated with Conservation Strategies[1]
(acre-feet per year)

Water User Group	2010	2020	2030	2040	2050	2060
Iowa Park	21	57	68	72	76	80
Wichita Falls	124	533	548	556	562	1,367
Bowie	8	34	34	61	69	72
Lakeside City[2]	3	9	10	11	11	11
Archer County-Other	7	11	14	16	17	18
Clay County-Other	16	42	45	45	41	39
Montague County-Other[2]	18	78	80	80	81	81

1. It is assumed that there are no savings directly from water audits. Savings are associated with system improvements as the result of water audits.

2. Per capita water use is less than 140 gpcd.

Table ES-13

Projected Water Savings as Percent of Municipal Demand

Water User Group	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Iowa Park	1.72%	4.85%	5.76%	6.14%	6.51%	6.84%
Wichita Falls	0.54%	2.42%	2.40%	2.45%	2.48%	5.98%
Bowie	0.76^	3.43%	3.53%	6.43%	7.30$	7.64%
Lakeside City	0.58%	1.68%	1.93%	2.07%	2.11%	2.13%
Archer County-Other	1.27%	2.45%	2.78%	3.08%	3.46%	3.77%
Clay County-Other	1.84%	4.87%	5.25%	5.78%	6.77%	7.37%
Montague County-Other	1.76%	7.93%	8.26%	8.45%	8.56%	8.59%

There are 11 municipal users in Region B that have been identified with water needs relating to quantity, quality, or reliability. These users include Archer County (Other), Baylor WSC, Clay County (Other), Montague County (Other), City of Bowie, City of Iowa Park, City of Lakeside City, City of Wichita Falls, Charlie WSC, Hinds-Wildcat System, and Lockett Water System.

Based on a comparison of the total regional water supply to demand as shown in the previous Table ES-6, it was determined that there is adequate water supply to meet the needs of Region B as a whole up to the year of 2019. However, by the year 2020, the region is projected to have a supply shortage of 716 acre-feet per year and by 2060 the shortage will increase to 16,112 acre-feet per year.

In addition, based on a comparison of the supply to demand of each water user group in Region B, the various water needs were identified and water management strategies were evaluated to meet each need. Though all the strategies may be viable options and should be considered by each affected entity, the following is a listing by county of the preferred water management strategies for each water user group with projected water supply needs.

Archer County

The maximum projected water need for Archer County is 1,892 acre-feet per year. Most of this need (1,584 acre-feet per year) is associated with the irrigation supply shortage from Lake Kemp.

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
Archer Co. (other)	Municipal Conservation	18 [1.]	1.72	2010
	Purchase water from Local Provider	296	5.26	2010
Lakeside City	Municipal Conservation	11 [1.]	1.39	2010
	Purchase water from Wichita Falls	12	3.25	2010
Archer Co. Irrigation	Increase water conservation elevation at Lake Kemp	1,584 [1.]	0.01	2010
TOTAL		1,921		
ALTERNATE STRATEGIES – NONE IDENTIFIED				

1. Supply varies by decade. The amount shown is the supply from this strategy in year 2060.

Baylor County

There is a safe supply water shortage in Baylor County of Region B, for Baylor WSC and an interconnect to Millers Creek Reservoir is recommended.

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
Baylor WSC	Interconnect Millers Creek Reservoir	250	$3.84	2010

Clay County

The maximum projected water need for Clay County is 582 acre-feet per year. Most of this need (349 acre-feet per year) is associated with the irrigation supply shortage from Lake Kemp.

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
Clay Co. (other)	Municipal Conservation	39 [1.]	0.78	2010
	Purchase water from Local Provider	223	$4.44	2010
Clay Co. Irrigation	Increase water conservation elevation at Lake Kemp	274 [1.]	$0.01	2020
Charlie WSC	Nitrate Removal Plant	10	$7.83	2010
TOTAL		546		
ALTERNATE STRATEGIES – NONE IDENTIFIED				

1. Supply varies by decade. The amount shown is the supply from this strategy in year 2060.

Cottle County

There are no projected water shortages in Cottle County of Region B.

Foard County

There are no projected water shortages in Foard County of Region B.

Hardeman County

There are no projected water shortages in Hardeman County of Region B.

King County

There are no projected water shortages in King County of Region B.

Montague County

The maximum projected water need for Montague County is 932 acre-feet per year. Most of this need (584 acre-feet per year) is associated with a safe need for Montague County (other).

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
Montague Co. (other)	Develop Additional Groundwater Supplies	584	$1.88	2010
City of Bowie	Municipal Conservation	72 [1.]	$0.71	2010
	Wastewater Reuse	171	$2.92	2040
Montague Co. (Mining)	Purchase Water from Local Provider	177	$4.18	2010
TOTAL		1,004		
ALTERNATE STRATEGIES				
Montague Co. (other)	Purchase water from Local Provider	584	$3.68	2010
City of Bowie	Develop Additional Groundwater Supply	171	$3.68	2040
Montague Co. (Mining)	Develop Additional Groundwater Supply	177	$1.37	2010

1. Supply varies by decade. The amount shown is the supply from this strategy in year 2060.

Wichita County

The maximum projected water need for Wichita County is 31,633 acre-feet per year. Most of this need (27,201 acre-feet per year) is associated with the irrigation supply shortage from Lake Kemp.

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
City of Iowa Park	Municipal Conservation	80 [1.]	$0.83	2010
	Purchase Water from Wichita Falls	229	$3.25	2010
City of Wichita Falls	Municipal Conservation	1367 [1.]	$0.24	2010
	Increase water conservation elevation at Lake Kemp	3,340	$0.01	2020
	Construction Lake Ringgold	27,000	$4.32	2050
Wichita Co. Irrigation	Increase water conservation elevation at Lake Kemp	8,687 [1.]	$0.01	2020
	Wichita River Diversion	8,850	$0.22	2040
	Enclose Canal Laterals in Pipe	13,034	$0.16	2010
Wichita County Manufacturing	Purchase Water From Wichita Falls	462	$3.25	2010
TOTAL		63,049		
ALTERNATE STRATEGIES				
City of Wichita Falls	Wastewater Reuse	11,000	$3.25	2010

1. Supply varies by decade. The amount shown is the supply from this strategy in year 2060.

Wilbarger County

The maximum projected water need for Wilbarger County is 10,864 acre-feet per year. Most of this need (10,715 acre-feet per year) is associated with the steam-electric power supply shortage from Lake Kemp.

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
Lockett Water System	Purchase water from City of Vernon	109	$6.96	2010
Hinds-Wildcat System	Nitrate Removal Plant	40	$4.18	2010
Wilbarger Co. Steam Electric Power	Increase Water Conservation elevation at Lake Kemp	10,715 [1.]	$0.01	2020
TOTAL		10,864		
ALTERNATE STRATEGIES				
Hinds-Wildcat System	Purchase water from City of Vernon	40	9.36	2010

1. Supply varies by decade. The amount shown is the supply from this strategy in year 2060.

Young County

There are no projected water shortages in the portion of Young County in Region B.

Regional Strategies

The Chloride Control Project in the Wichita River Basin (Not the full Red River Chloride Control Project (RRCCP)) is a recommended regional strategy for Region B. This project will provide water savings through increased efficiencies in municipal water treatment and irrigation use due to improved water quality.

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
Regional	Wichita Basin Chloride Control Project (WBCCP)	26,500	$0.88	2010

Impacts of Selected Water Management Strategies on Key Parameters of Water Quality and Impacts of Moving Water From Rural and Agricultural Areas

The Region B Water Planning Group is proposing eight preferred water management strategies. Each of the strategies were evaluated and it was determined that none of the proposed strategies are likely to have significant adverse impacts on water quality within the region. In addition, though some additional agricultural lands may be utilized to develop needed groundwater supplies, the impact on agricultural lands is expected to be minimal.

Water Conservation and Drought Management Recommendations

Water conservation is a potentially feasible water savings strategy that can be used to preserve the supplies of existing water resources. Some of the demand projections developed for regional water planning incorporate an expected level of conservation to be implemented over the planning period. For municipal use, the assumed reductions in per capita water use are the result of the implementation of the State Water-Efficiency Plumbing Act. On a regional basis, this is about a 5.4 percent reduction in municipal water use by year 2060 (from a regional per capita use of 165 gallons per person per day to 156 gallons per person per day). Additional municipal water savings are expected as the federal mandate for energy efficient clothes washing machines took effect in 2007.

Water conservation and drought management are often a way of life in Region B. With frequent periods of drought, water providers recognize the importance of active management and conservation of local water resources. The Region B Water Planning Group also recognizes that advanced water conservation measures (i.e. savings associated with active conservation measures for municipal and industrial uses) will be implemented by local governing entities or water users as conditions arise. The recommended strategies presented in this plan provide a framework from which water providers can use to develop plans and/or strategies to meet their needs. Region B Planning Group supports the use and consideration of any water conservation strategy deemed appropriate by a water user.

Acknowledging the importance of water conservation to meet future water needs in Region B, this water plan recommends several water conservation strategies for users with identified needs:

- Municipal conservation
- Municipal reuse
- Irrigation conveyance loss reduction

The amount of conservation from each of these strategies is shown in Table ES-14, and represents approximately 96 percent of the total supply in 2010 and 20% in 2060 from all recommended strategies.

Table ES-14
Summary of Recommended Strategies
(acre-feet per year)

	2010	2020	2030	2040	2050	2060
Conservation Strategies						
Additional Municipal Conservation	197	764	799	841	857	1,668
Bowie Reuse				171	171	171
Lake Kemp Canal Project	13,034	13,034	13,034	13,034	13,034	13,034
Total Conservation	**13,231**	**13,798**	**13,833**	**14,046**	**14,062**	**14,873**
Other New Supplies						
Increase Conservation Elev. of Lake Kemp	0	24,834	24,776	24,718	24,660	24,600
Wichita River Diversion	0	0	0	8,850	8,850	8,850
Groundwater Development Montague County-Other	485	554	572	584	567	572
Construct Lake Ringgold	0	0	0	0	27,000	27,000
Total – New Supplies[1]	**13,716**	**39,204**	**39,181**	**48,198**	**75,139**	**75,895**
% Conservation	96%	35%	35%	29%	19%	20%

[1] New supplies include conservation savings.

Description of How The Regional Water Plan is Consistent With Long-Term Protection of The State's Water Resources, Agricultural Resources, And Natural Resources

The development of viable strategies to meet the demand for water is the primary focus of regional water planning. However, another important goal of water planning is the long-term protection of resources that contribute to water availability, and to the quality of life in the State.

To be considered consistent with the long-term protection of the State’s water, agricultural, and natural resources the Region B Plan must recommend strategies that minimize threats to the region’s sources of water over the planning period. The water management strategies were evaluated and the recommended strategies represent a comprehensive plan for meeting the needs of the region while effectively minimizing threats to water resources.

Agriculture is an important economic cornerstone of Region B. Given the relatively low rainfall, irrigation is a critical aspect of agriculture in the region. The source of most of the region's irrigation is the Lake Kemp/Lake Diversion system, which provides water via a canal system located in Archer, Wichita, and Clay Counties.

Protection of the Lake Kemp/Lake Diversion system has been a central focus of the water planning process for Region B.

Region B contains many natural resources that must be considered in water planning. Natural resources include threatened or endangered species; local, state, and federal parks and public land; and energy/mineral reserves. The Region B Water Plan is consistent with the long-term protection of these resources.

Recommendations Including Unique Ecological Stream Segments, Reservoir Sites, Legislative & Regional Policy Issues

In accordance with 31 TAC 357.7 (a)(9), 31 TAC 357.8, and 31 TAC 357.9, the following recommendations are proposed to facilitate the orderly development, management, and conservation of the water resources available within Region B:

- It is recommended that the Chloride Control Project on the Wichita River and the Pease River be made a regional priority in order to enhance the water quality of Lake Kemp and Lake Diversion, and reclaim those lakes as a viable cost effective short term and long term regional water supply source.

- Based on the results of the Lake Kemp and Lake Arrowhead brush management studies, it is recommended that the State consider providing adequate funding to implement brush management and other land stewardship programs in an attempt to increase watershed yields.

- Region B recommends that the state support both federal and state efforts to rehabilitate existing sediment control structures and encourage funding and support for the construction of new structures and other land management practices in watersheds that would produce the greatest sediment control benefits.

- Region B recommends that no segments be designated as "Unique Stream/River Segments" at this time. Pending the results of comprehensive studies and clarification of the significance and impacts of designation, the Regional Water Planning Group may consider designations within the region in the future.

- Region B requests that the Legislature extend the protections for unique reservoir sites beyond the current expiration date of September 1, 2015, to ensure that reservoir sites such as Lake Ringgold that are identified as water management strategies but not required until late in the planning period (2050) remain protected under the Texas Water Code until applications and permits are filed.

- It is recommended that the state regulatory agencies consider allowing continued long-term use of bottled water programs, and/or providing a waiver for small user groups that can demonstrate they have no reasonable cost-effective means to comply with the current nitrate MCL of 10 mg/l.

- It is recommended that the state fund the development, implementation, and evaluate the necessary management strategies adopted as part of this regional plan. This includes strategies identified to meet a specific need as well as general strategies to increase water supply in the region.

- It is recommended that the Legislature support the grass-roots regional water planning process enacted by SB1 and strongly encourages the process be continued with adequate state funding for all planning efforts including administrative activities and data collection.

- It is recommended that the state continue to fund agricultural water use data collection and agricultural water use management/conservation projects.

- Senate Bill 1 requires future projects to be consistent with the approved regional water plan to be eligible for TWDB funding and TCEQ permitting. It is recommended that surface water uses that will not have a significant impact on the region's water supply and water supply projects that do not involve the development of or connection to a new water source should be deemed consistent with the regional water plan even though not specifically recommended in the plan.

- With regards to conservation it is recommended that the Legislature continue to allow each region to establish realistic, appropriate, and voluntary water conservation goals as opposed to the establishment of statewide standards.

- Region B recommends that the gallons per capita per day (gpcd) calculation of water use be based on residential water use only.

CHAPTER 1

DESCRIPTION OF REGION

TEXAS STATE WATER PLAN

REGION B

SEPTEMBER 2010

DESCRIPTION OF REGION
TEXAS STATE WATER PLAN
REGION B

1.1 Region B Overview

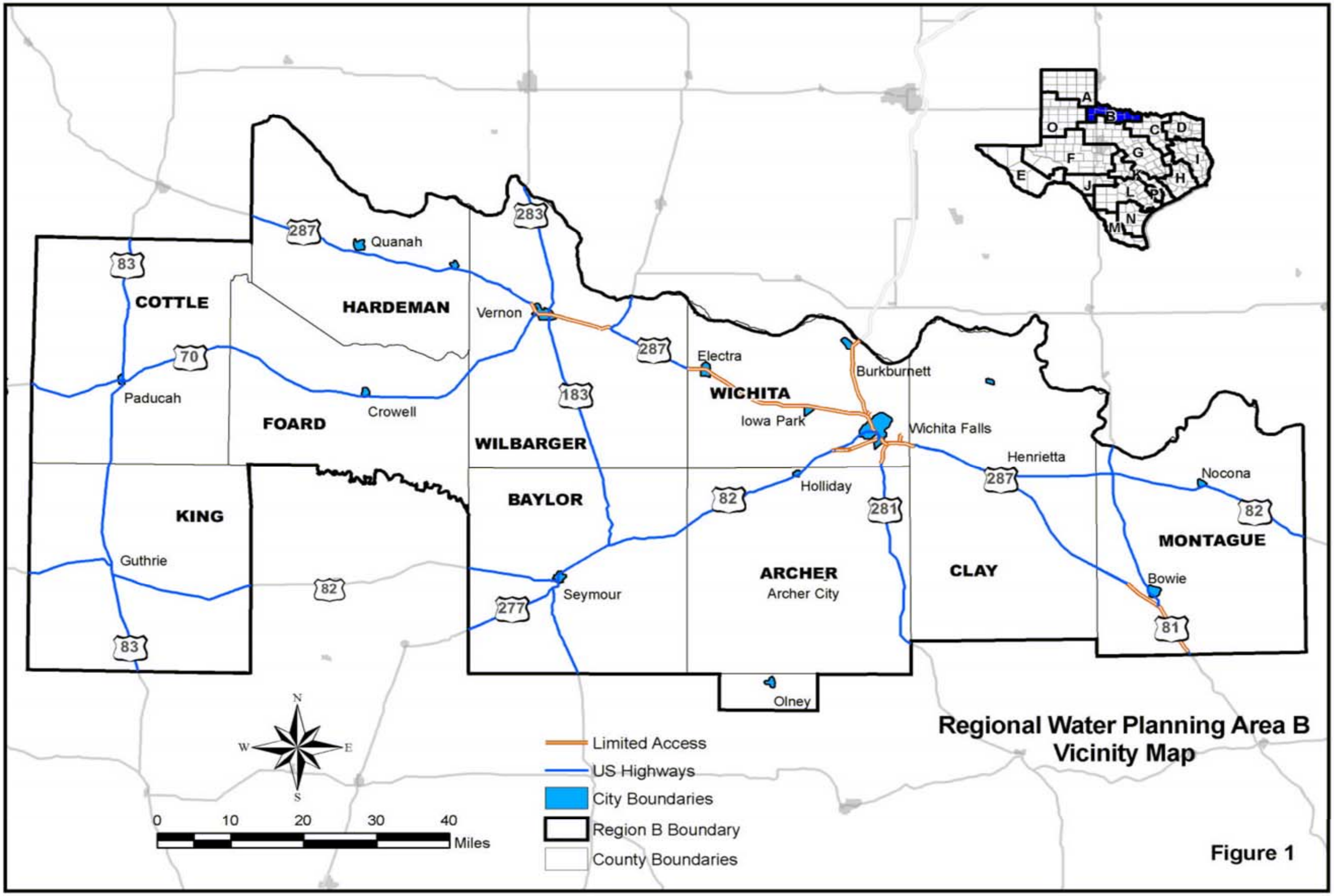
Senate Bill 1 of the 75th Texas Legislature was passed in 1997 to set the process of developing a comprehensive state water plan. To accomplish this task, the state was divided into 16 regional water planning groups. This report describes Region B as designated by Senate Bill 1. Region B is comprised of ten entire counties and a portion of one county in north central Texas. Specifically, those counties are Archer, Baylor, Clay, Cottle, Foard, Hardeman, King, Montague, Wichita, Wilbarger, and the City of Olney in Young County. Figure 1 shows the region, cities, towns, and the counties it encompasses.

Region B lies mainly in the Red River Basin, however, southern portions of Archer, Clay, and Montague Counties lie in the Trinity River Basin, and southern portions of Archer, Baylor, and King Counties lie in the Brazos River Basin, as shown on the Surface Water Map in Figure 2.

In 2000, the total population of the region was reported to be 201,970, with the largest population center, the City of Wichita Falls, being 104,197 or 52 percent of the total. The second largest city was Vernon with a population of 11,660.

1.2 Population And Demographic Data

In general, most of the population is concentrated in eastern portions of the region with over one-half located in and around Wichita Falls. The January 1, 2000 estimated population density of the region ranged from a high of 210 persons per square mile (Wichita County) to a low of less than one person per square mile (King County). Regional population is forecasted to increase by approximately 10 percent over the study period. The forecasts of projected populations will be examined in more detail in Chapter 2 of this report. Table 1-1 shows the 1990 census population by county and the corresponding census population in 2000. Tables 1-2 through 1-5 give a more in-depth breakdown of the regional demographics.



Regional Water Planning Area B Vicinity Map

Figure 1

Table 1-1:
County Populations

County	Area (sq. mi)	1990 Population	2000 Population	% Change	2000 Density people/sq.mi.
Archer	910	7,973	8,854	11.0%	10
Baylor	871	4,385	4,093	-6.7%	5
Clay	1,098	10,024	11,006	9.8%	10
Cottle	901	2,247	1,904	-15.3%	2
Foard	707	1,794	1,622	-9.6%	2
Hardeman	695	5,283	4,724	-10.6%	7
King	912	354	356	0.6%	< 1
Montague	931	17,274	19,117	10.7%	21
Wichita	628	122,378	131,664	7.6%	210
Wilbarger	971	15,121	14,676	-2.9%	15
Young	2	3,519	3,396	-3.5%	1617

The following tables describe the demography of the region as of the 2000 census.

Table 1-2:
2000 Demographics – Breakdown by Race

	Percentage Of Population That Is…				
County	White	Black	Hispanic	Native	Asian
Archer	95.5%	0.1%	4.9%	0.6%	0.1%
Baylor	91.0%	3.3%	9.3%	0.6%	0.5%
Clay	95.3%	0.4%	3.7%	1.0%	0.1%
Cottle	81.5%	9.9%	18.9%	0.0%	0.0%
Foard	84.2%	3.3%	16.3%	0.6%	0.2%
Hardeman	85.4%	4.8%	14.5%	0.8%	0.3%
King	94.1%	0.0%	9.6%	1.1%	0.0%
Montague	96.0%	0.2%	5.4%	0.7%	0.3%
Wichita	78.8%	10.2%	12.2%	0.9%	1.8%
Wilbarger	79.2%	8.9%	20.5%	0.7%	0.6%
Young	91.1%	1.2%	10.6%	0.6%	0.3%
Average	88.4%	3.8%	11.4%	0.7%	0.4%

Table 1-3:
2000 Demographics – Breakdown by Age

County	Percentage of Population That is Age…							
	<5	5-17	18-24	25-44	45-64	65-74	75-84	85
Archer	6.3	21.9	7.0	27.4	23.5	7.9	4.3	1.7
Baylor	4.9	18.5	5.5	21.4	25.6	12.0	9.0	3.5
Clay	5.8	19.0	6.8	26.4	25.9	9.3	4.8	2.0
Cottle	5.1	18.9	5.7	21.5	23.3	11.0	10.0	4.3
Foard	5.7	20.1	5.8	22.3	22.9	9.7	8.3	5.2
Hardeman	6.5	18.8	7.5	22.6	24.3	9.4	7.6	3.2
King	6.7	27.0	3.7	29.5	22.8	7.9	2.0	0.6
Montague	6.0	18.0	6.8	24.3	25.1	10.0	6.8	2.6
Wichita	7.0	18.2	13.7	29.0	19.5	6.9	4.3	1.5
Wilbarger	6.6	21.3	9.5	24.8	21.6	7.4	5.9	2.8
Young	6.0	19.0	7.0	24.7	23.6	9.9	6.9	2.9

Table 1-4:
2000 Demographics – Breakdown by Income and Education

County	Median Family Income	High School Diploma or Better	Bachelor's Degree or Better	Family Income Below Poverty Level
Archer	$45,984.00	81.1%	15.9%	6.8%
Baylor	$34,583.00	70.1%	12.1%	12.9%
Clay	$41,514.00	80.4%	13.9%	8.1%
Cottle	$33,036.00	66.1%	15.3%	13.7%
Foard	$34,211.00	70.0%	10.5%	9.9%
Hardeman	$33,325.00	70.7%	12.8%	14.6%
King	$36,875.00	78.1%	24.6%	17.9%
Montague	$38,226.00	73.0%	11.3%	10.0%
Wichita	$40,937.00	79.9%	20.0%	10.3%
Wilbarger	$38,685.00	72.2%	17.1%	9.0%
Young	$36,698.00	72.1%	14.4%	12.0%
Average	$37,643.00	74.0%	15.3%	11.4%

Table 1-5:
2000 Demographics – Breakdown by Occupation

County	Percentage of Population That Work In…						
	Management	**Service**	**Sales**	**Farming**	**Construction**	**Production**	**Unemployed**
Archer	30.4%	14.0%	22.1%	3.0%	13.8%	16.7%	2.2%
Baylor	36.3%	17.4%	21.5%	4.6%	11.6%	8.5%	2.4%
Clay	28.7%	13.3%	25.5%	3.8%	11.5%	17.3%	2.2%
Cottle	30.2%	20.5%	20.7%	7.1%	13.0%	8.5%	3.3%
Foard	32.6%	18.7%	16.5%	4.9%	10.6%	16.7%	1.2%
Hardeman	27.2%	21.0%	17.4%	3.9%	12.6%	18.0%	2.5%
King	32.9%	14.1%	20.1%	18.1%	8.7%	6.0%	0.0%
Montague	25.7%	16.8%	21.4%	1.5%	14.1%	20.4%	3.2%
Wichita	28.9%	18.8%	26.4%	0.4%	10.0%	15.6%	3.3%
Wilbarger	28.3%	22.8%	22.0%	1.7%	8.4%	16.8%	2.2%
Young	26.3%	16.2%	24.2%	1.6%	13.3%	18.3%	3.0%
Average	29.8%	17.6%	21.6%	4.6%	11.6%	14.8%	2.3%

1.3 Water Use Demand Centers

The City of Wichita Falls is the largest demand center in the region. Other demand centers include Seymour, Henrietta, Quanah, Bowie, Nocona, Burkburnett, Electra, Iowa Park, Vernon, Olney, and Archer City. Table 1-6 below shows the population of these demand centers and also the gallons per capita per day (GPCD) usage for each center.

Table 1-6:
Regional Demand Centers

County	City	2000 Population	2000 Municipal Water Use (Ac-Ft)	Water Use (GPCD)
Archer	Archer City	1,848	232	112
Baylor	Seymour	2,908	554	170
Clay	Henrietta	3,264	526	144
Hardeman	Quanah	3,022	565	167
Montague	Bowie	5,219	824	141
Montague	Nocona	3,198	484	135
Wichita	Burkburnett	10,927	1,273	104
Wichita	Electra	3,168	337	95
Wichita	Iowa Park	6,431	1,232	171
Wichita	Wichita Falls	104,197	21,942	188
Wilbarger	Vernon	11,660	2,795	214
Young	Olney	3,396	609	160

While the population of Region B is only expected to reach near 222,000 by 2060, the Dallas-Fort Worth Metroplex, located just east of the region, is expected to top 9 million. This population could likely impose increasing pressures on the water base recreational resources of the Region, as the number of people willing to travel into Region B for recreational purposes increase.

1.4 Water Supply and Use

Water providers have continuously strived to develop the water resources in Region B so that they can deliver potable water to the people, irrigation water to the farmers and ranchers, and water to promote industrial and economic growth. In 1901, the dam at Lake Wichita in Wichita County was completed, signifying the beginning of 90 years of water management for recreation, irrigation, and human consumption for north central Texas. In 1924, the dam at Lake Kemp was completed, making it one of the largest man-made lakes in the world. The lake was originally designed for flood prevention and water supply, however, soon after construction, it was determined that its water was too saline to drink. This led to the discovery of natural salt-water springs in Foard, King, and Knox Counties which have caused the water in the Big Wichita and Pease Rivers to be very difficult to treat for human consumption, consequently it has been only used for irrigation and steam electric power purposes until recently. This natural phenomenon has prompted the Red River Authority to initiate the Red River Chloride Control Project on the Big Wichita River. By building brine lakes and low-flow dams, the amount of dissolved solids and chlorides in the water has been reduced. As a result, water from Lake Kemp may be utilized for other uses. In fact, in May 2009 the City of Wichita Falls completed a 10 MGD reverse osmosis (R.O.) plant to treat Lake Kemp water and supplement their current water supply.

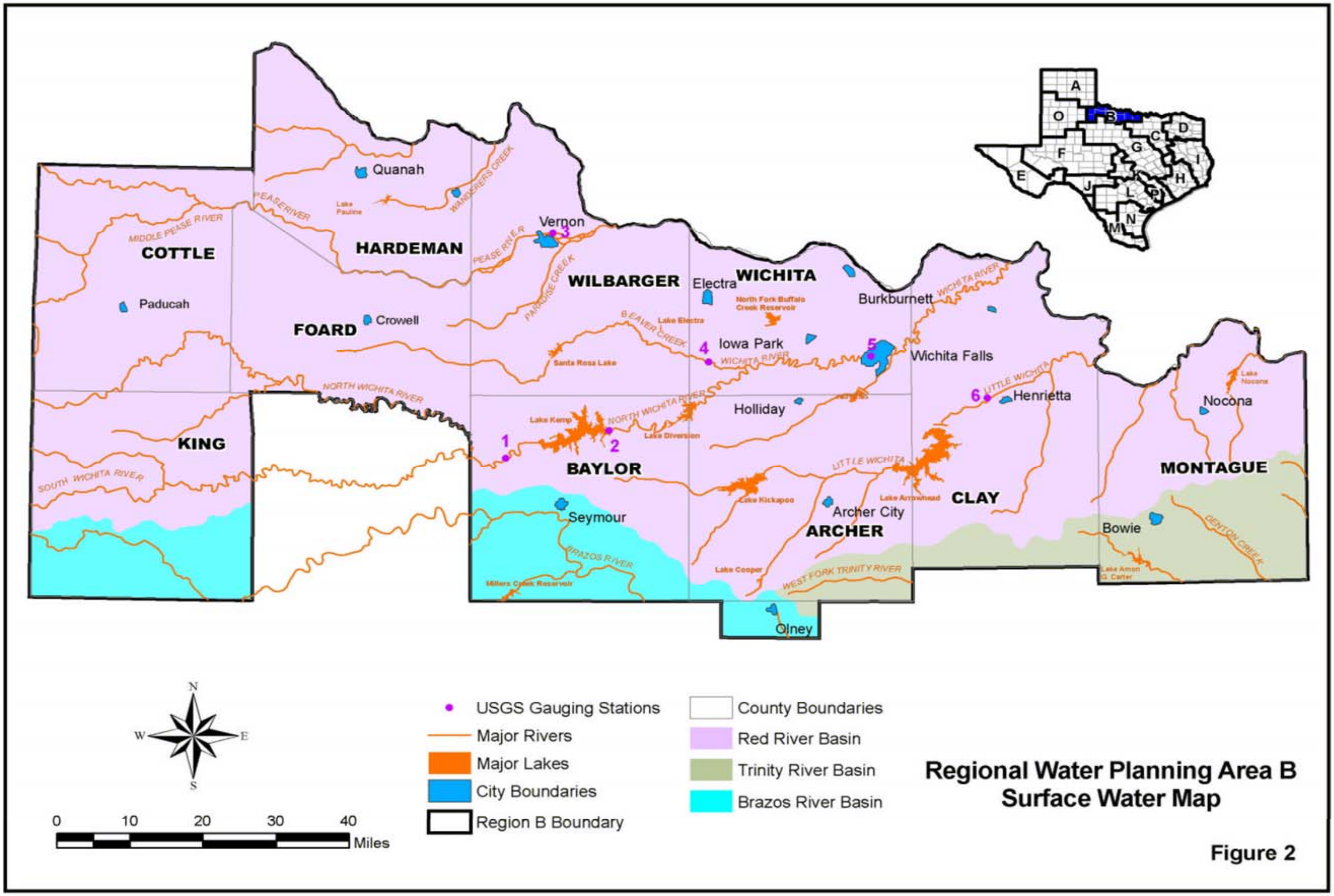
There are 10 significant lakes and 4 major streams that are used for water supply in the region. Figure 2 - "Surface Water Map" shows the location of the major surface water sources in Region B. Charts 1 through 12 depict the average monthly and average annual stream flows in cubic feet per second (CFS) at various USGS gauging stations which are shown on Figure 2. (NOTE: The site number shown for each chart represents the USGS gauging station shown on Figure 2.)

Table 1-7 shows the Year 2000 firm yield for each significant lake in Region B.

Table 1-7:
Year 2000 Firm Yields for Lakes in Region B

Water Source	Basin	Lake Firm Yield (ac-ft)	Conservation Capacity (ac-ft)
Lake Kemp/Diversion	Red River	105,500	245,434
Lake Kickapoo/Arrowhead	Red River	46,200	321,822
Amon Carter Lake	Trinity	2200	27826
Lake Electra	Red River	470	5,606
Lake Nocona	Red River	1,260	21,749
Olney Lake	Red River	960	6,165
Santa Rosa Lake	Red River	3,075	8,245
North Fork Buffalo Cr.	Red River	840	14,378
Lake Pauline	Red River	1,200	3,297

In addition to the lakes listed in the previous table, some municipalities and water supply corporations obtain their raw water from wells.



Regional Water Planning Area B Surface Water Map

Figure 2

Chart-1:

Streamflow Data – Site 1

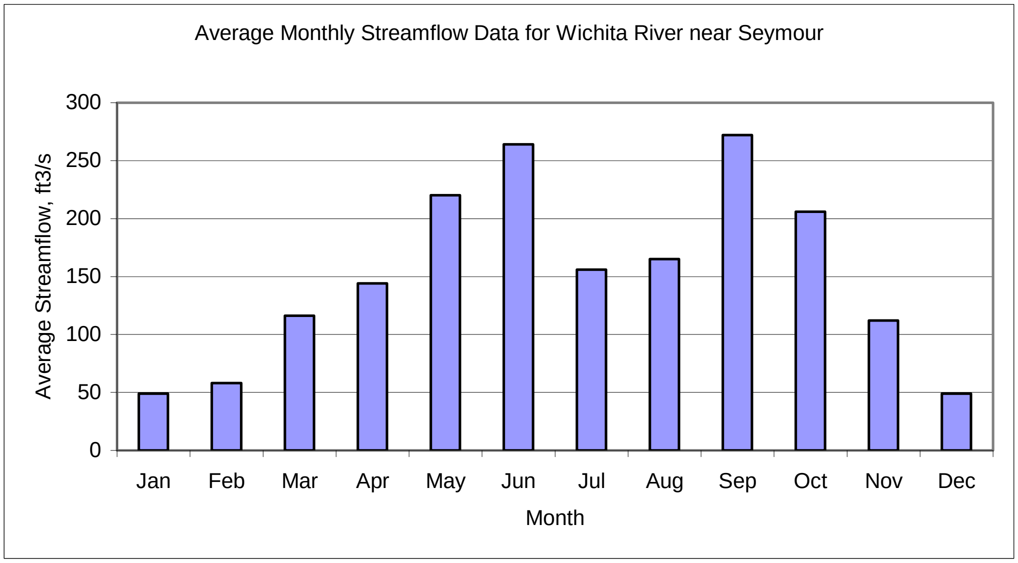
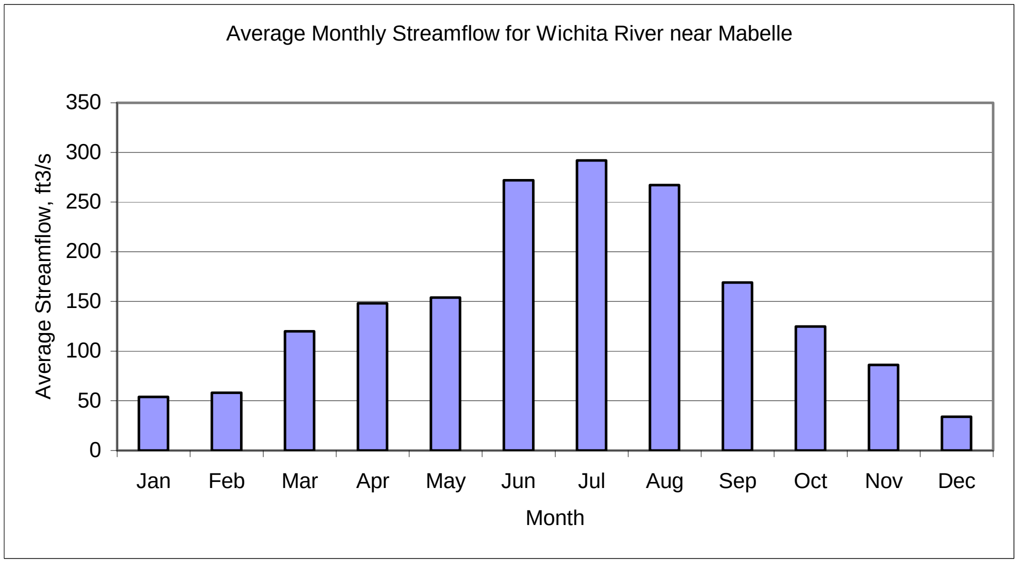


Chart-2:

Streamflow Data – Site 2



Note: Streamflows at this site are influenced by releases from Lake Kemp for irrigation and industrial diversions.

Chart-3:
Streamflow Data – Site 3

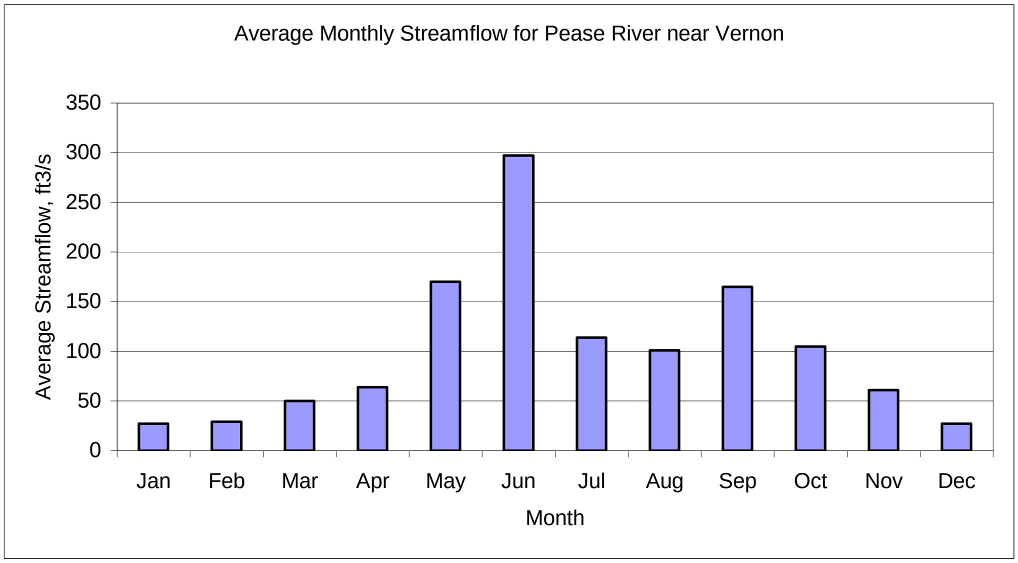


Chart-4:
Streamflow Data – Site 4

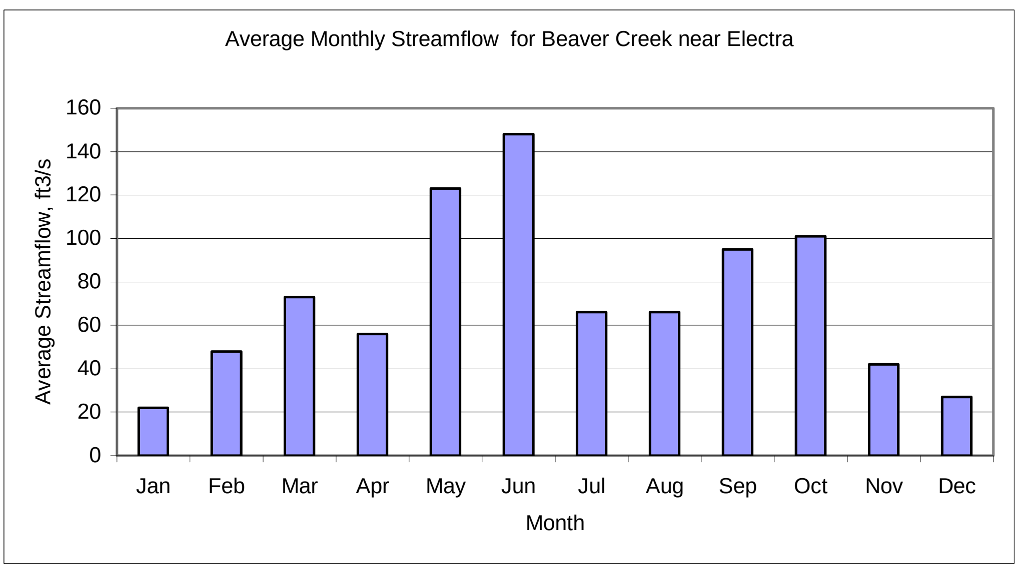


Chart-5:
Streamflow Data – Site 5

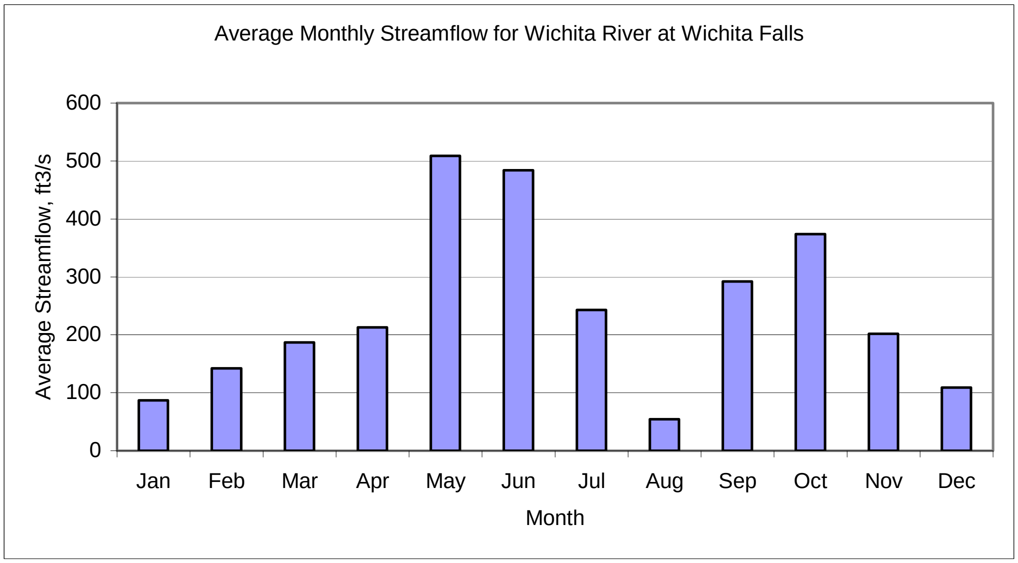


Chart-6:
Streamflow Data – Site 6

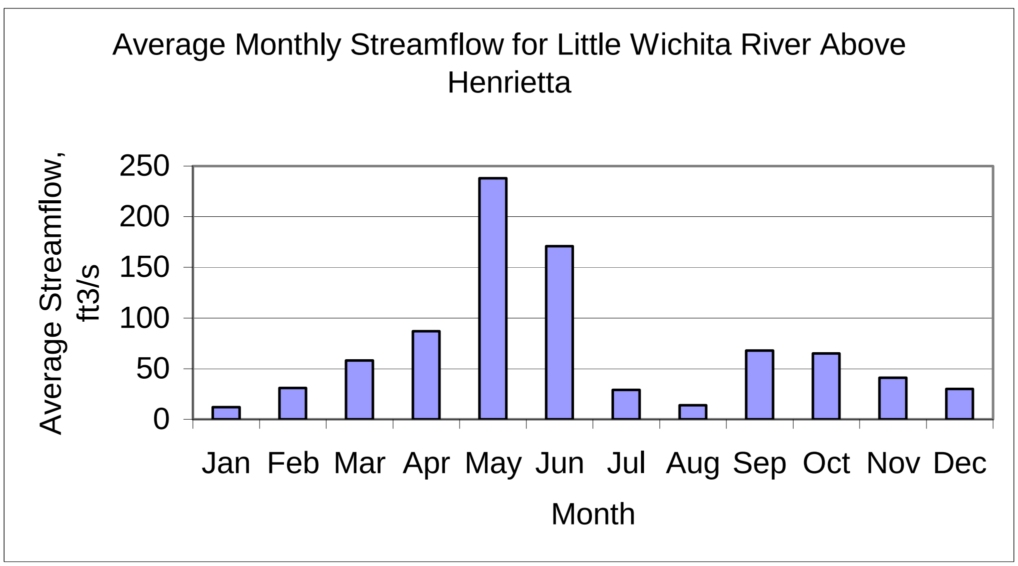


Chart-7:
Streamflow Data – Site 1

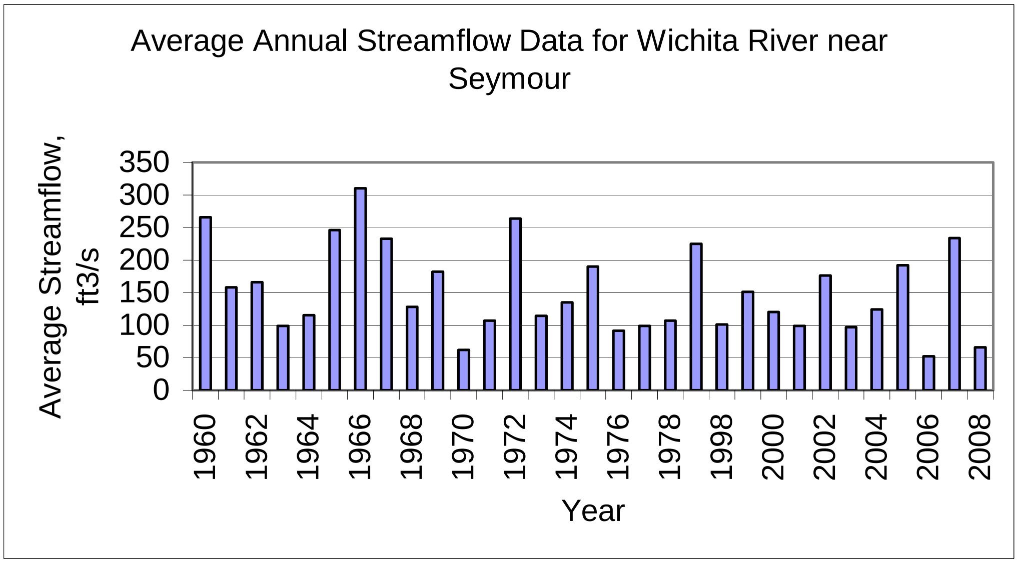


Chart-8:
Streamflow Data – Site 2

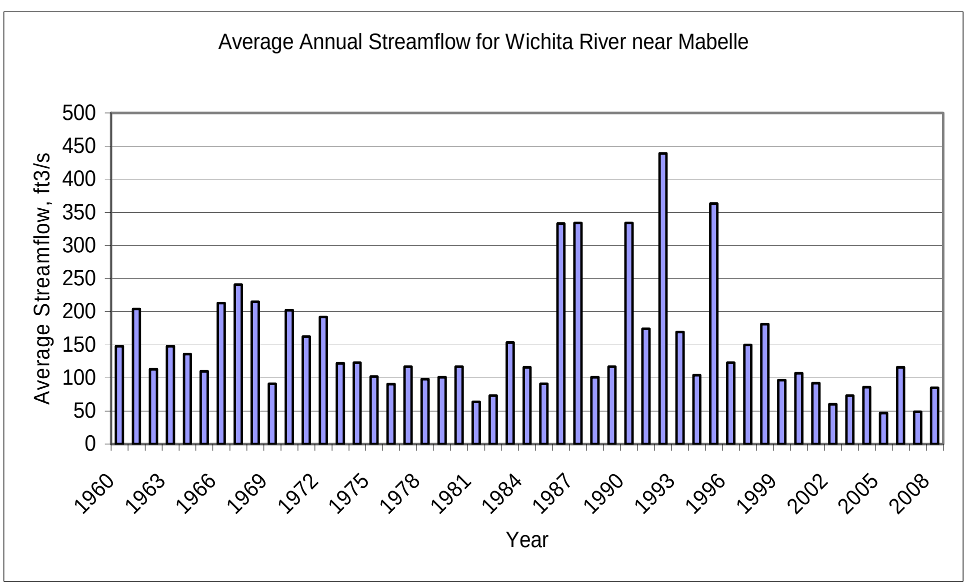


Chart-9:
Streamflow Data – Site 3

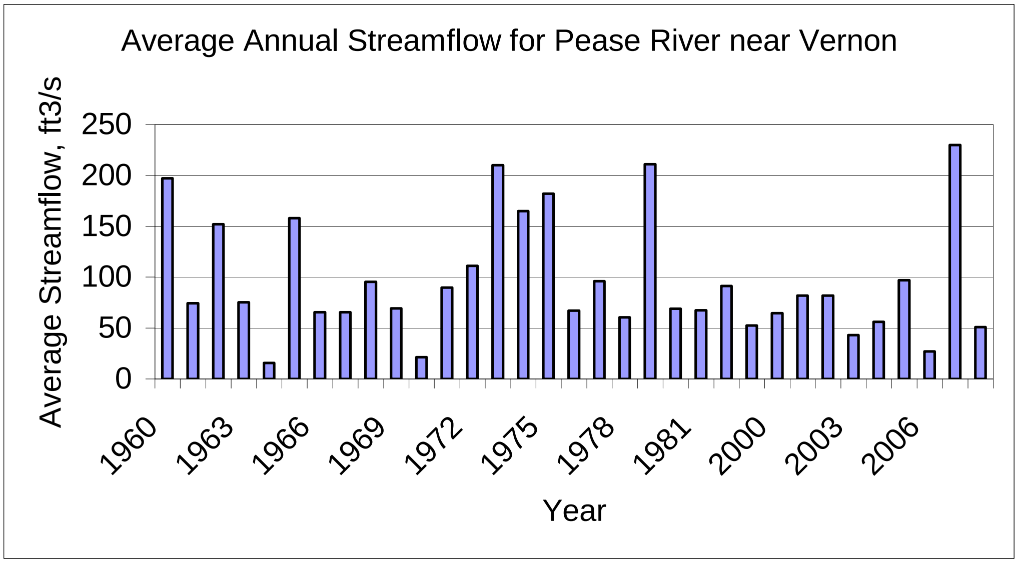


Chart-10:
Streamflow Data – Site 4

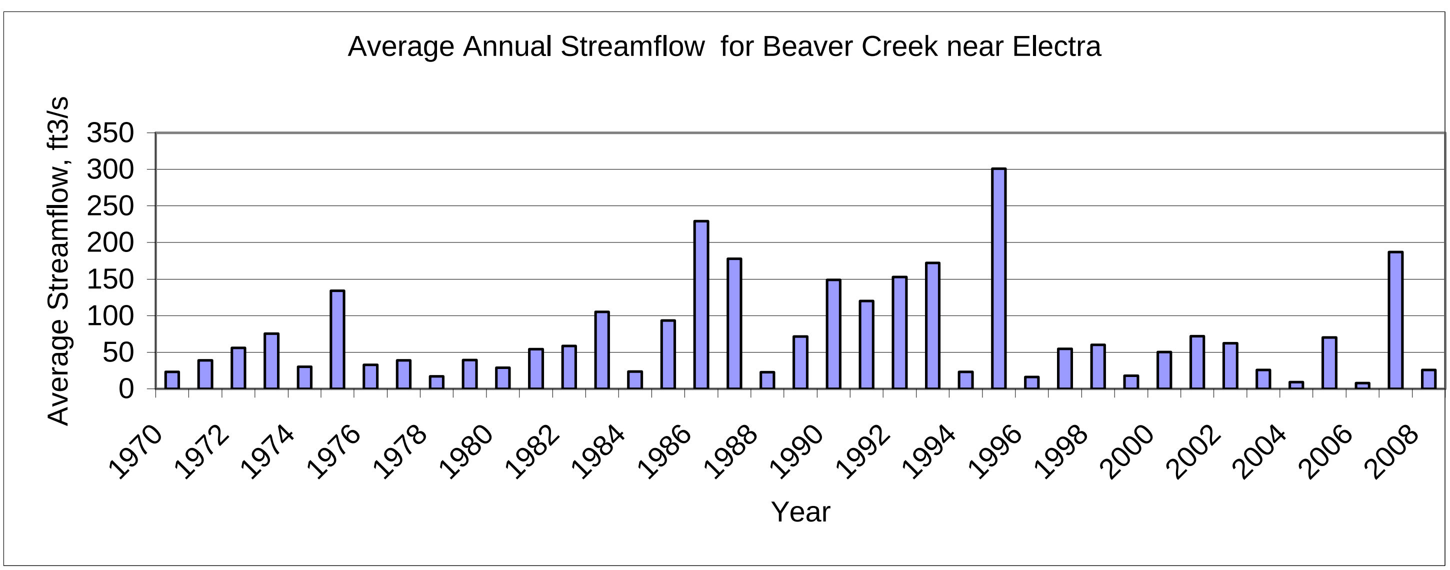


Chart-11:
Streamflow Data – Site 5

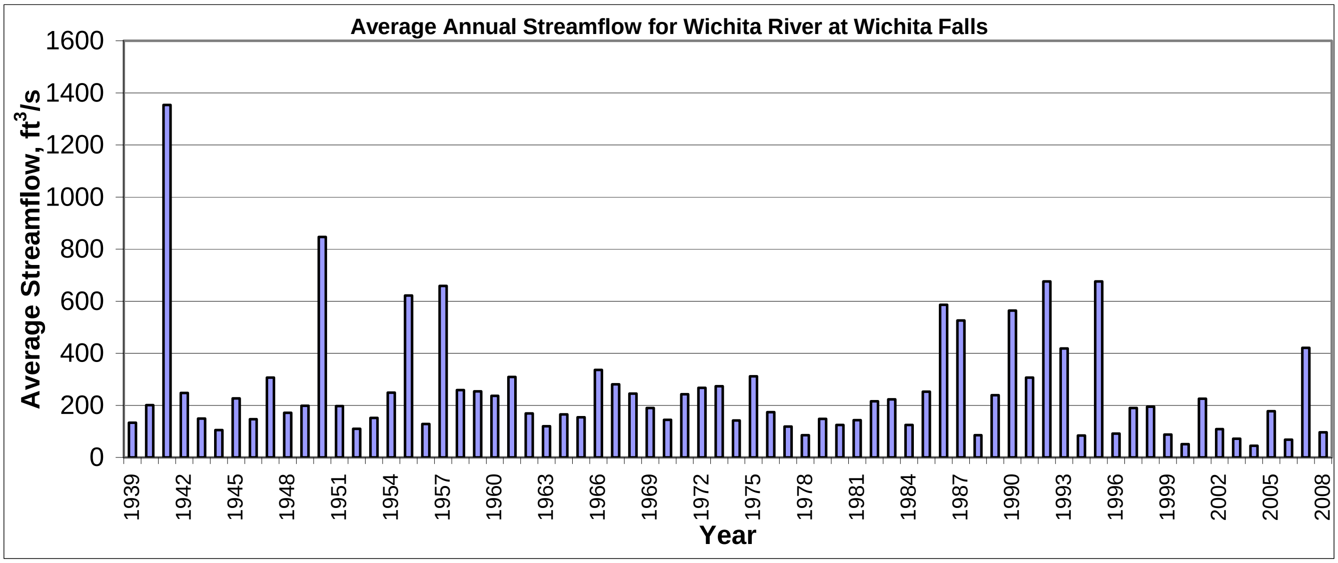
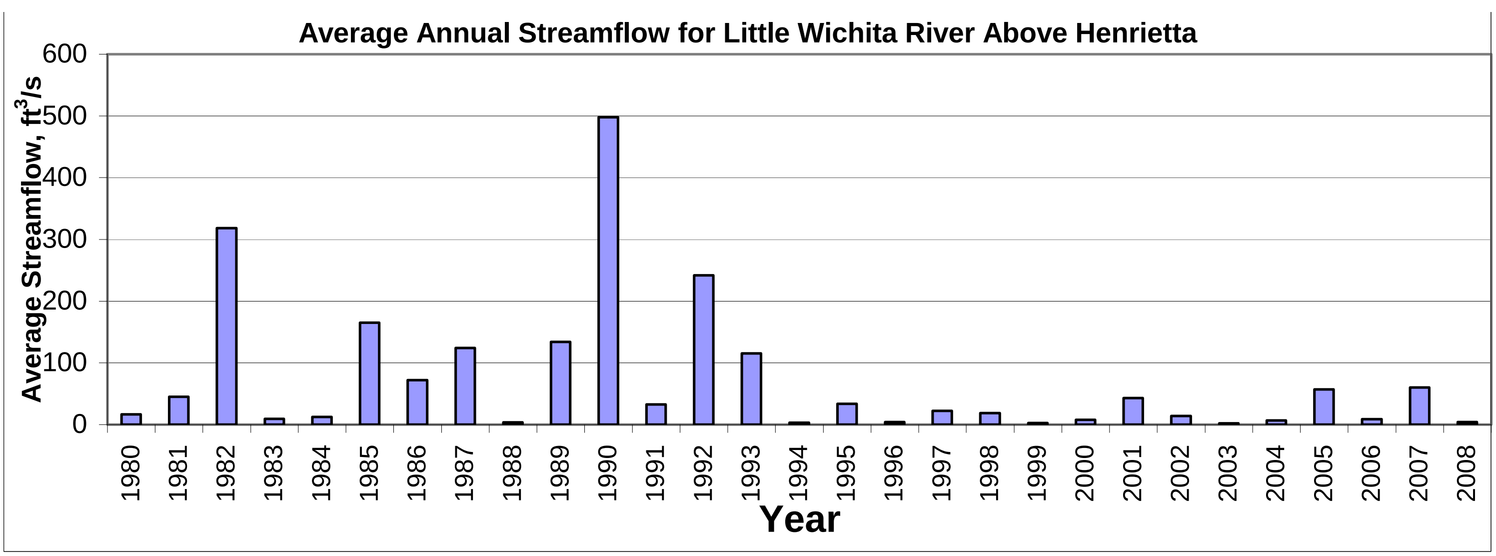


Chart-12:
Streamflow Data – Site 6



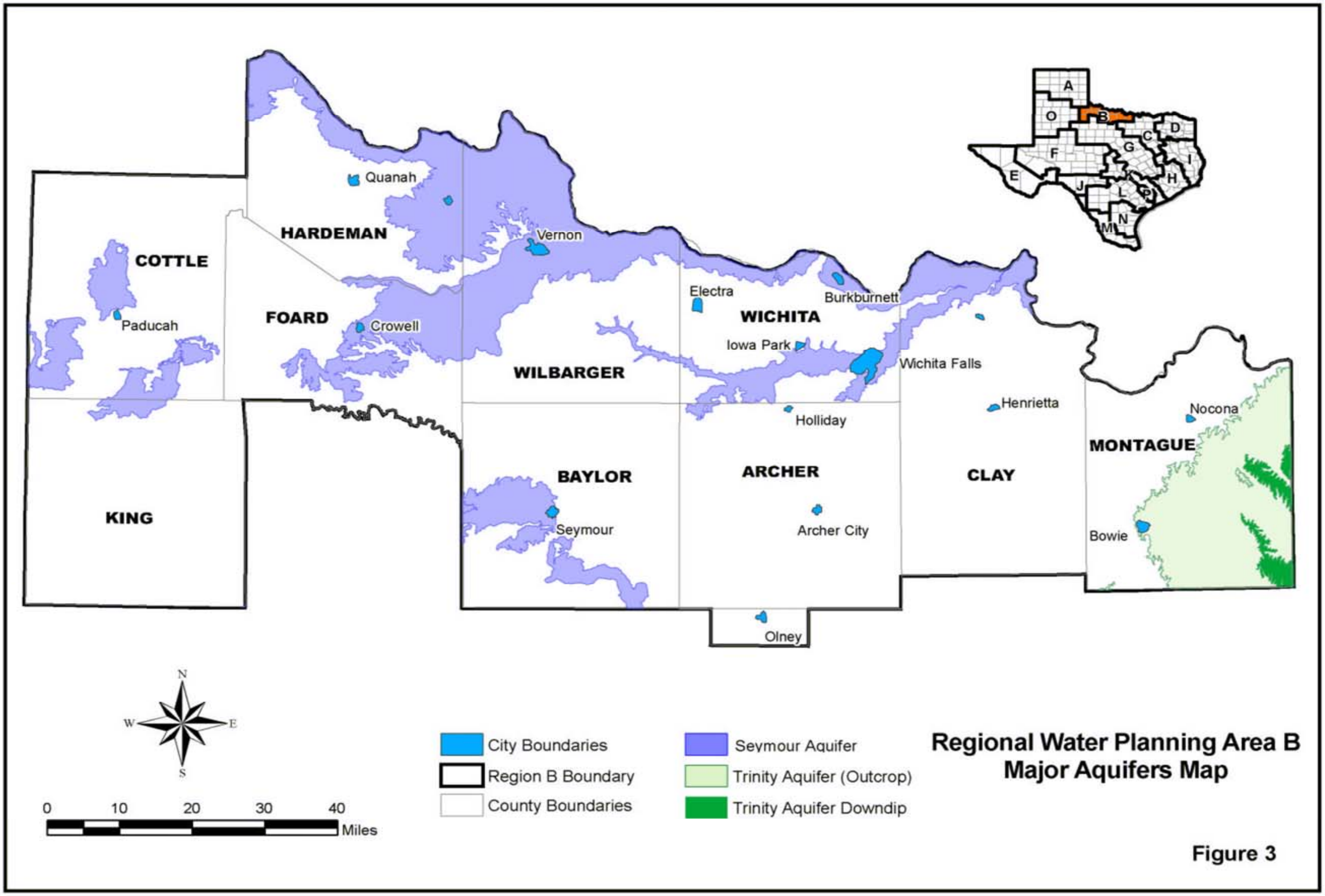
There are two major aquifers (Seymour and Trinity) and one minor aquifer (Blaine) in Region B. The Seymour Aquifer, found in the western portions of the region, is utilized for irrigation purposes in addition to being pumped for municipal use by the cities of Vernon, Burkburnett, and Seymour as well as rural water supply corporations and rural communities.

Extreme northern reaches of one of the state's most expansive aquifers, the Trinity Aquifer, lies in western and southern Montague County, the easternmost county in Region B. Water from this area of the aquifer is used mainly for irrigation purposes, due to its relatively low well yield. Figure 3 shows the location of the major aquifers within Region B.

Figure 4 shows the location of the only minor aquifer in Region B, known as the Blaine Aquifer. The Blaine Aquifer is found only in Cottle, Foard, Hardeman, Knox, and King Counties of Region B, and the large majority of the water pumped from this aquifer is used for agricultural purposes. The water pumped from this aquifer is high in dissolved solids from natural halite dissolution. In addition to the natural contamination, significant pollutants are also present in the aquifer as a result of human activities such as oil and gas production and agriculture.

At one time, nearly 150 natural springs and seeps across the area were known to exist within Region B. While some continue to produce water today, many of these springs have dried up over time due to over-pumping of the groundwater for municipal, agriculture, industrial, and mining use. A few small producing springs feed natural ponds and creeks that are habitat for many plants and animals. It should be recognized that any future development of underground sources of water, as well as the overuse of existing surface water supplies, may cause a decline in the viability of existing springs.

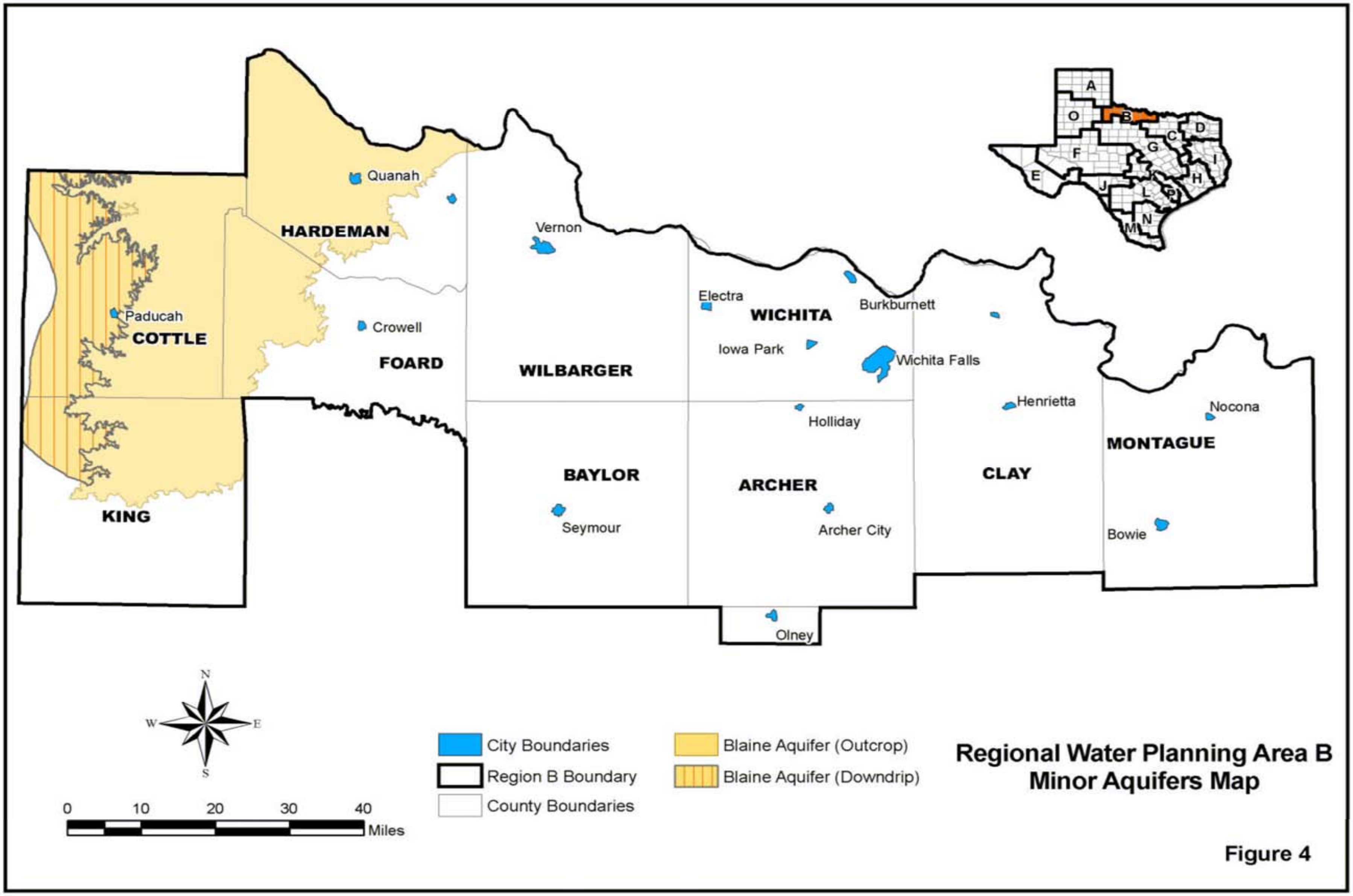
Agriculture irrigation is the main component of regional water use, accounting for approximately 60 percent of all water used. Irrigation water is currently provided from Lakes Kemp and Diversion through a distribution system of canals and pipe by the Wichita County Water Improvement District, the major irrigation provider in the region. A significant amount of irrigation is also provided from groundwater. Irrigation use in the region is expected to decline to 54 percent of the total use throughout the study period as more efficient pumping and irrigation techniques and equipment are implemented across the region. Municipal use is expected to remain relatively constant due to conservation, while steam-electric use is expected to increase from 9,841 acre-feet (ac-ft) in the year 2000 to 21,360 Ac-Ft in the year 2060. The overall water use in the region is projected to remain relatively constant throughout the study period. Figure 5 shows the actual water use by category for Region B in 1990 and 2000. The 2060 projections are taken from Chapter 2 of this report.



Regional Water Planning Area B
Major Aquifers Map

Figure 3

U:/F



Quanah
HARDEMAN
Vernon
Paducah
COTTLE
Crowell
FOARD
WILBARGER
Electra
WICHITA
Burkburnett
Iowa Park
Wichita Falls
Henrietta
Holliday
Nocona
MONTAGUE
BAYLOR
ARCHER
CLAY
KING
Seymour
Archer City
Bowie
Olney
A
O
B
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10
20
30
40
Miles
City Boundaries
Region B Boundary
County Boundaries
Blaine Aquifer (Outcrop)
Blaine Aquifer (Downdrip)
Regional Water Planning Area B
Minor Aquifers Map
Figure 4

U:

Figure 5

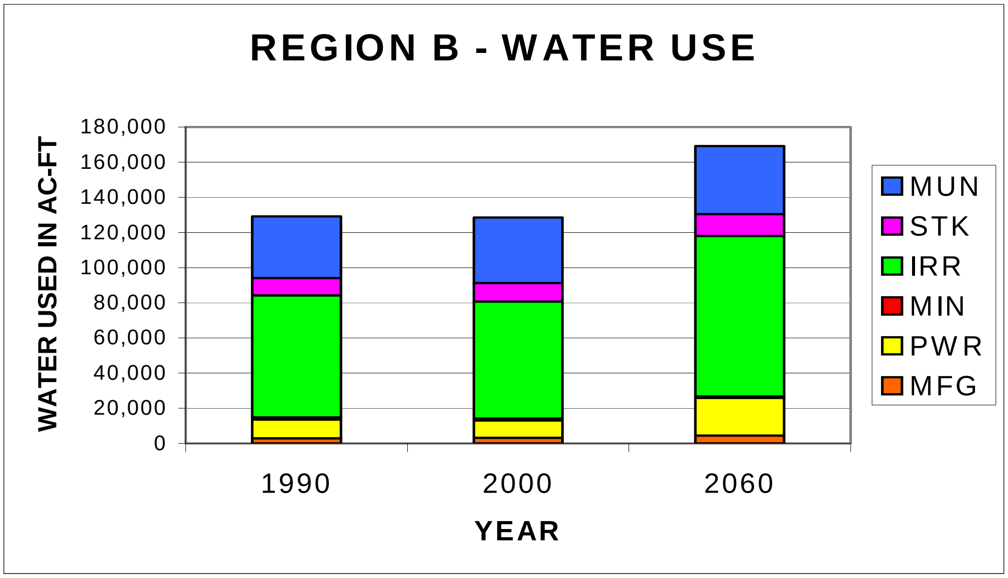

Table 1-8 shows the water rights holders of Region B and their permitted and actual usage.

Table 1-8:
Surface Water Rights Holders and Their Usage

Rights Holder	Water Supply	Permitted Use (ac-ft)	Reported Use			
			1999	2000	2001	2008
A.L. Rhodes	Little Wichita River	3,600	NR	NR	NR	NR
City of Bowie	Amon G. Carter	5,000	750	983	NR	NR
Peba Oil & Gas Co.	Red River	1,600	Abandoned 9/3/99			
N. Montague Co. MWA	Lake Nocona	1,260	689	517	522	NR
Red River Authority	South Wichita River	8,780	4,094	3,039	3,406	3828
Lonnie D. Allsup	Trib. Of Wichita River	2,150	360	360	NR	NR
City of Wichita Falls	Lake Wichita	7,961	0	0	0	0
Wichita County WID #2	Ls. Kemp & Diversion	193,000	52,216	54,562	71,741	126,642
W.T. Waggoner Estate	Ls. Santa Rosa & Wharton	3,070	101	96	86	96
City of Electra	Lake Electra	1,400	306	174	102	NR
City of Wichita Falls	Lake Kickapoo	40,000	6,170	6,717	11,813	9.782
City of Olney	Ls. Olney & Cooper	1,260	556	146	666	NR
City of Wichita Falls	Lake Arrowhead	45,000	23,762	19,750	12,948	11,932
City of Wichita Falls	Little Wichita River	2,352	0	0	0	0
City of Henrietta	Little Wichita River	1,560	694	556	638	475
American Electric Power	Lake Pauline	3,616	31	983	495	NR

A more detailed analysis of water use and water use projections is presented in Chapters 2 and 3 of this report.

1.5 Climate Data

The best way to describe the weather of Region B is volatile. It has the ability to change from one extreme to another in a short period of time. Annual precipitation can also vary greatly from year to year. The average annual rainfall for the region is 27.4 inches; however, the extremes range from 47 inches in 1919 to 12 inches in 1896. Table 1-9 shows monthly averages and records for the Wichita Falls area and Table 1-10 lists temperatures and rainfall for each county in the region.

Table 1-9:
Monthly Averages and Records for Wichita Falls

Monthly Avg's	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High Temp.	52.1	58.1	67.2	75.5	83.5	91.7	97.2	95.8	87.5	77.1	63.7	54.5
Low Temp.	28.9	33.4	41.1	49.3	59.3	67.8	72.4	71.3	63.7	52.4	40.1	31.3
Precipitation	1.12	2.39	2.27	2.62	3.92	3.69	1.58	2.39	3.19	3.11	1.62	1.68
Monthly Rec's	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
High Temp.	87	93	100	102	110	117	114	113	111	102	89	88
Low Temp.	-12	-8	6	24	36	50	54	53	38	21	14	-7
Snowfall	9.8	9.0	9.7	1.0	0.0	0.0	0.0	0.0	0.0	1.0	6.3	7.0
Rainfall	2.25	2.97	3.60	3.87	5.12	5.36	3.10	4.52	6.19	4.00	3.15	3.12

Table 1-10:
Temperature Extremes and Average Rainfall

	Temperature (F°)		Annual
	Jan. Mean Min.	July Mean Max.	Rainfall (in)
Archer	29	98	29.3
Baylor	26	97	27.3
Clay	26	97	31.9
Cottle	25	96	22.3
Young	26	96	30.6
Foard	24	97	23.9
Hardeman	23	97	24.5
King	24	98	23.8
Montague	31	96	32.9
Wichita	29	97	28.8
Wilbarger	25	97	25.7

The region is obviously drier in the western areas and has more rainfall in eastern and southern counties.

Since 1930, the entire state has experienced 7 major droughts. Two of these droughts have occurred in the past 8 years, in 2002 and 2006. It has been predicted that between 15 and 30 percent of Texas farmers may quit the business this year due to recent droughts. This fact is particularly significant for Region B since agriculture is a major contributor to the economy of the region.

1.6 Economic Aspects of Region B

The 3 main components of the region's economy are farming, ranching, and mineral production.

The Texas Railroad Commission reports that Region B has approximately 28,199 producing oil wells and 790 gas wells. Table 1-11 provides a tabulation by county of the current oil and gas wells, as of September, 2009.

Table 1-11:
Number of Oil and Gas Wells

County	Oil Wells	Gas Wells
Archer	5,298	5
Baylor	386	2
Clay	1,964	76
Cottle	59	102
Foard	151	140
Hardeman	339	2
King	868	55
Montague	3,164	52
Wichita	10,164	3
Wilbarger	1,658	2
Young	4,148	351
Total	28,199	790

The service infrastructure is also strong. Some of the services offered throughout Region B include agribusiness, oilfield service, grain, fiber, and food processing. Wichita County, the most populous county in the region, is the retail trade center for a large area. Sheppard Air Force Base and medical services also are big contributors to the economy of Wichita County. The region boasts a variety of manufacturing. Some areas of manufacturing include oilfield equipment, clothing, building products, plastics, electronics, wood products, and aircraft equipment.

1.7 Land Use

Region B includes some of the largest ranches in the state, including the Waggoner Ranch in Wilbarger County and the Four Sixes Ranch in King County. It has over 1 million acres of croplands and over 3 million acres of open range. Table 1-12 shows land use percentages for each county in the region (data for Montague County was unavailable). Percentages under the heading of "Conservation" represent lands that had previously been croplands, but have been converted to the Conservation Reserve Program. The Conservation Reserve Program, or CRP, subsidizes farmers and landowners to convert highly erodible farmland to permanent grassland for a period of ten years.

Table 1-12:
Percentage of Land Use by County

County	Crops	Federal	Conservation	Pasture	Range	Urban	Water	Transportation
Archer	16.2%	<0.1%	1.0%	1.6%	77.0%	0.9%	2.2%	1.1%
Baylor	29.0%	-	1.6%	1.7%	61.2%	0.7%	4.9%	0.8%
Clay	19.3%	-	0.6%	6.1%	67.9%	1.6%	3.1%	1.5%
Cottle	14.7%	-	12.7%	0.9%	65.3%	0.3%	2.1%	0.6%
Foard	21.2%	-	14.9%	-	62.4%	-	0.6%	0.9%
Hardeman	37.5%	-	15.4%	0.4%	42.2%	1.2%	1.7%	1.6%
King	9.7%	-	2.3%	0.4%	86.4%	0.0%	0.5%	0.6%
Montague	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Wichita	40.5%	1.1%	1.5%	3.8%	38.7%	9.9%	1.5%	3.0%
Wilbarger	37.2%	-	7.3%	6.7%	46.6%	<0.1%	0.9%	1.3%
Young	30.6%	-	0.8%	2.7%	61.0%	1.6%	2.1%	1.3%

Typical crops in Region B include cotton, coastal bermuda, wheat, alfalfa, peanuts, grain sorghum, watermelons, pecans, peaches, and other various fruits. Cattle for beef and dairy production is the major component of the livestock industry, with sheep, swine, and equine also present.

1.8 Navigable Waterways

Navigable waters of the United States are those waters that are subject to the ebb and flow of the tide and/or presently being used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. Based on information from the U.S. Army Corps of Engineers, there are no navigable waters within Region B.

1.9 Ecology and Wildlife

Most of Region B lies in the area known as the “Rolling Plains” with the exception of Montague County, which lies in the "Oakwoods and Prairies" area. The Texas Parks and Wildlife Department describes the “Rolling Plains” region as a “gently rolling plain of mesquite and short grass savanna.” The open range is generally characterized by its mesquite brush, prairie grasses, and sandstone outcroppings and cottonwood, hackberry, and saltcedar brush can be found near most rivers and streams. This vegetation is important to the survival of both resident and migratory birds. It is evident by the widespread mesquite, however, that over-grazing, soil erosion, and the lowering of the groundwater table have all contributed to the decline of the native grasslands. The topography of the region gently slopes to the east and southeast. The Red River and its major tributaries drain most of the region; however, extreme southern reaches of the region are drained by tributaries of the Brazos and Trinity Rivers.

The Texas Parks and Wildlife Department uses freshwater mussels as water quality indicators because they are usually the first organisms to show their sensitivity to changes in aquatic quality. Recent surveys have determined that 52 separate species of mussels have declined[1]. Another organism used to indicate water quality is the minnow. Since 1950, minnows native to the Big Wichita River System have also shown serious declines. These native minnows include the plains minnow, the silver chub, and several varieties of shiner. The plains minnow is commonly used in support of a significant commercial baitfish industry. The decline of these organisms indicates poor water conservation and management. Runoff and scouring flows have increased with broad increases in over-grazing, highway development, and general land clearing. Scouring flows can cause excessive sedimentation, thus eliminating the natural habitats of these organisms.

The "Rolling Plains" region of Texas is not usually thought of as an area rich in wetland habitats. However, the region is actually very important to both migrating and wintering waterfowl. In fact many species of migrating shorebirds, raptors, and other birds stop over in the region to feed and rest on the available wetlands.

There are over 40 species of water-dependent reptiles, amphibians, and mammals that live in the study area. Some of these include minks, muskrats, beavers, snakes, turtles, salamanders, and frogs. Fish species present in the study area include drum, carp, buffalo, bluegill, sunfish, largemouth and white bass; white crappie; flathead, blue, and channel catfish. Some endangered species are also present across the region. Table 1-13 lists the endangered and threatened species present in the region.

Copper Breaks State Park located 12 miles south of Quanah in Hardeman County contains 1,889 acres, and a 70 acre lake. The park has abundant wildlife, and according to the 1998 Texas Almanac, is home for part of the official Texas Longhorn herd.

Table 1-13:
Region B - Endangered/Threatened Species

SPECIES	STATE STATUS	FEDERAL STATUS
Reddish Egret	Threatened	
American Peregrine Falcon	Endangered	Endangered
Arctic Peregrine Falcon	Threatened	Endangered
Whooping Crane	Endangered	Endangered
Brown Pelican	Endangered	Endangered
White-Faced Ibis	Threatened	-
Interior least tern	Endangered	Endangered
Black-capped Vireo	Endangered	Endangered
Shovelnose Sturgeon	Threatened	-
Texas Kangaroo Rat	Threatened	-
Black-footed Ferret	Endangered	Endangered
Brazos Water Snake	Threatened	-
Texas Horned Lizard	Threatened	-

1.10 Summary of Existing Local or Regional Water Plans

In April, 2009 a Water Conservation Implementation Plan was prepared for Wichita County Water Improvement District No. 2. This plan will be used to meet the irrigation needs in the region by replacing/enclosing selected portions of the canal laterals that have the largest quantities of water loss. The Executive Summary of the Implementation Plan is included in Attachment 4-4 of this 2011 Regional Water Plan Update.

Also since January 2006, information was gathered from water providers of Region B to determine, among other things, if they possessed a water conservation plan or a local or regional water plan. Table 1-14 lists the results of those surveys and inquiries.

Table 1-14:
Survey Results Regarding Water Plans
(Municipal Providers)

Water Provider	Existing Drought Contingency Plan?	Existing Water Conservation Plan?	Existing Local or Regional Water Plan?	Special Concerns of the Provider
Archer County MUD	Y	Y	N	Supply
Arrowhead Lake Water System	Y	Y	N	
Arrowhead Ranch Estates Water System	Y	Y	N	
Baylor County WSC	N	N	N	Nitrates
Box Community Water System	N	N	N	
City of Archer City	Y	Y	N	
City of Bowie	Y	Y	N	
City of Burkburnett	Y	Y	N	Nitrates
City of Byers	N	N	N	Nitrates
City of Charlie	N	N	N	Nitrates
City of Crowell	Y	N	N	Nitrates
City of Dumont	N	N	N	
City of Electra	Y	Y	N	Nitrates
City of Henrietta	Y	Y	Y	
City of Holliday	Y	Y	N	
City of Iowa Park	Y	Y	N	
City of Lakeside City	Y	Y	N	Storage
City of Megargel	Y	N	N	
City of Nocona	N	N	N	
City of Nocona Hills	Y	Y	Y	Nitrates
City of Olney	N	Y	N	Storage
City of Paducah	N	N	N	
City of Petrolia	N	N	N	
City of Pleasant Valley	N	N	N	
City of Quanah	N	N	N	
City of Saint Jo	Y	Y	N	
City of Scotland	Y	N	N	
City of Seymour	N	N	N	Nitrates
City of Sunset	N	N	N	Storage
City of Vernon	Y	Y	Y	Nitrates
City of Wichita Falls	Y	Y	Y	
Dean Dale WSC	Y	Y	N	
Farmers Valley Water System	Y	Y	N	
Foard County Water System	Y	Y	N	
Forestburg WSC	N	N	N	
Goodlett Water System	Y	Y	N	
Hinds Water System	Y	Y	N	
Horseshoe Bend WSC	N	N	N	
Lockett Water System	Y	Y	N	
Medicine Mound Water System	Y	Y	N	
Northside WSC	Y	Y	Y	Nitrates
Quanah NE Water System	Y	Y	N	
Ringgold Water System	Y	Y	N	
South Quanah Water System	Y	Y	N	
Wichita Valley WSC	Y	Y	N	
Windthorst WSC	Y	Y	N	

1.11 Summary of Recommendations

It is anticipated that with the implementation of the recommended Water Management Strategies, Region B will have adequate water supplies throughout the planning period. The main recommendations of the Plan are increase water conservation elevation at Lake Kemp and to employ conservation measures to reduce water waste. Also, the heavy dissolved solid and chloride concentrations in the western portions of the region are preventing the full utilization of the available water resources. To reduce this, it is recommended that the Red River Chloride Control Project, sponsored by the Red River Authority of Texas, continue to be funded and operated.

1.12 Identification of Known Threats to Agriculture or Natural Resources

Excessive concentrations of total dissolved solids, sulfate, and chloride are a general problem in most streams of the Red River Basin under low flow conditions. The high salt concentrations are caused, in large part, by the presence of salt water springs, seeps, and gypsum outcrops. Salt water springs are generally located in the western portion of the (Red River) basin in the upper reaches of the Wichita River, the North and South Forks of the Pease River, and the Little Red, which is a tributary to the Prairie Dog Town Fork of the Red River. Gypsum outcrops are found in the area ranging westward from Wichita County to the High Plains Caprock Escarpment.

The excessive amounts of dissolved solids and chlorides in the water present problems to managers, planners, and others concerned with water treatment for municipal use. For this reason, the quality of the available water supply is as much an issue as the quantity for Region B. Water consumers of all kinds, whether municipal, industrial, or agricultural, desire water that is less saline; however, these conditions have existed for many years, and the plants and animals that live with them have adapted well. The Red River Authority of Texas is sponsoring a federal chloride control project to control the natural chloride level in the Red River Basin by impounding high chloride waters from the natural brine springs.

In addition, there are areas in Region B with highly erodible soils that contribute to an accumulation of sediment in the lakes and reservoirs. This sediment over time, can significantly reduce storage capacity and reliable water supplies.

There is limited recent information available with regards to groundwater levels and drawdown data within the region. However, historical use indicates that with the exception of Wilbarger County, much of the groundwater is not fully developed or not currently being used. Therefore, it is anticipated that additional groundwater can be developed to meet the projected water demands through the planning period with no known threats to Agriculture or Natural Resources.

1.13 Water Providers in Region B

Water is provided in Region B by a number of entities. The cities provide most of the municipal and manufacturing water in the region with the City of Wichita Falls providing the majority of the water. Other major providers include the Red River Authority of Texas and the Greenbelt Water Authority. The following Table 1-15 shows a comprehensive listing of the water providers and the municipal use for the year 2000. A more detailed discussion of water use is presented in Chapter 2 of this report. It should be noted that these use figures do not include water for irrigation, manufacturing, electrical power, livestock, or mining.

Table 1-15:

Water Providers and Users in Region B

USER	COUNTY	RIVER BASIN	2000 Water Use AF/YR
Archer City	Archer	RED	232
Holliday	Archer	RED	245
Lakeside City	Archer	RED	125
Seymour	Baylor	BRAZOS	554
Byers	Clay	RED	69
Henrietta	Clay	RED	526
Petrolia	Clay	RED	93
Paducah	Cottle	RED	247
Crowell	Foard	RED	250
Chillicothe	Hardeman	RED	151
Quanah	Hardeman	RED	565
Guthrie	King	RED	77
Bowie	Montague	TRINITY	824
Montague	Montague	RED	55
Nocona	Montague	RED	484
Saint Jo	Montague	TRINITY	210
Burkburnett	Wichita	RED	1,273
Electra	Wichita	RED	337
Iowa Park	Wichita	RED	1,232
Wichita Falls	Wichita	RED	21,942
Vernon	Wilbarger	RED	2,795
Olney	Young	BRAZOS	609
Other Rural			5,185
TOTAL			38,080

USER Other Rural	COUNTY	RIVER BASIN	2000 Water Use AF/YR
Baylor WSC	Archer	RED	18
Archer Co. MUD #1	Archer	RED	138
Megargel	Archer	RED	46
Scotland	Archer	RED	224
Windthorst WSC	Archer	RED	351
Wichita Valley WSC	Archer	RED	184
Archer Co. Other	Archer	RED	33
Archer Co. Other	Archer	TRINITY	24
Archer Co. Other	Archer	BRAZOS	36
Baylor WSC	Baylor	BRAZOS	190
Baylor Co. Other	Baylor	RED	22
Baylor Co. Other	Baylor	BRAZOS	90
Bellevue	Clay	RED	41
Bluegrove WSC	Clay	RED	7
Charlie WSC	Clay	RED	10
Dean Dale WSC	Clay	RED	217
Arrowhead Lake Water System	Clay	RED	95
Arrowhead Ranch Water System	Clay	RED	89
Friberg-Cooper WSC	Clay	RED	78
Clay Co. Other	Clay	RED	517
Clay Co. Other	Clay	TRINITY	68
King-Cottle WSC	Cottle	RED	75
Cottle Co. Other	Cottle	RED	6
Foard Co. WSD	Foard	RED	49
Margaret WSD	Foard	RED	17
Thalia WSC	Foard	RED	34
Foard Co. Other	Foard	RED	22

USER Other Rural	COUNTY	RIVER BASIN	2000 Water Use AF/YR
Goodlet Water System	Hardeman	RED	17
Medicine Mound Water System	Hardeman	RED	19
Quanah NE Water System	Hardeman	RED	59
S Quanah Water System	Hardeman	RED	19
Hardeman Co. Other	Hardeman	RED	74
King-Cottle WSC	King	RED	17
Dumont Water System	King	RED	30
King Co. Other	King	RED	2
King Co. Other	King	BRAZOS	3
Forestburg	Montague	RED	24
Montague Water System	Montague	RED	32
Nocona Hills WSC	Montague	RED	96
Oak Shores Water System	Montague	RED	5
Sunset Water System	Montague	RED	20
Ringgold WSC	Montague	RED	24
Montague Co. Other	Montague	RED	201
Montague Co. Other	Montague	TRINITY	796
Friberg Cooper WSC	Wichita	RED	92
Horseshoe Bend Water System	Wichita	RED	14
Pleasant Valley	Wichita	RED	101
Wichita Valley WSC	Wichita	RED	186
Dean Dale WSC	Wichita	RED	117
Box Com. Water System	Wilbarger	RED	19
Farmers Valley Water System	Wilbarger	RED	23
Harrold WSC	Wilbarger	RED	29
Hinds Com Water System	Wilbarger	RED	26
Lockett Water System	Wilbarger	RED	95
Northside WSC	Wilbarger	RED	37
Odell Water System	Wilbarger	RED	16
Oklaunion WSC	Wilbarger	RED	40
Wilbarger Co. Other	Wilbarger	RED	188
Young Co. Other	Young	BRAZOS	82
Young Co. Other	Young	TRINITY	1

1.14 Wholesale Water Providers

Each regional water planning group is required to designate its “Wholesale Water Providers” (WWP). According to the rules, a WWP is any person or entity, including river authorities and irrigation districts, which have contracts to sell more than 1,000 acre-feet of water wholesale in any one year during the five years immediately preceding the adoption of the last Regional Water Plan.

The only “Wholesale Water Provider” in Region B is the City of Wichita Falls.

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CHAPTER 2

POPULATION AND WATER USE PROJECTIONS

TEXAS STATE WATER PLAN

REGION B

SEPTEMBER 2010

POPULATION AND WATER USE PROJECTIONS
TEXAS STATE WATER PLAN
REGION B

2.1 Region B Overview

The eleven North Central Texas counties of Region B contain only one city larger than 100,000, which is Wichita Falls. The other communities are smaller and more rural in nature with incomes that are dependent on agriculture and, to a lesser extent, the oil industry. Consequently, the population for the region is projected to have only a moderate increase for the next sixty years from 201,970 people in 2000 to 221,734 in 2060, or 9.8 percent. Tables A-1 and A-2, in Attachment 2-1, summarize all of the population projections for the region through the year 2060 as adopted by the Regional Water Planning Group (RWPG). These projections were made by using the 1996 through 2000 population information as provided by the Texas State Data Center in conjunction with questionnaires mailed to every water provider in the Region.

Per capita municipal water use is predicted to gradually decline over the planning period from 165 gallons per capita per day (gpcd) in 2000 to 156 gpcd in 2060 based on water use and population projections. According to the 2007 Texas Water Plan published by the Texas Water Development Board, the municipal use for the entire state was shown to be 173 gpcd in 2000 and in 2060 the statewide use is predicted to decline to 162 gpcd. Region B's water use is currently in-line with the statewide average and is expected to decline in the future as predicted with the average. In the more densely populated areas where new construction is progressing at a faster pace than some rural areas, more water conserving measures can be implemented by requiring the newer plumbing fixtures and maintaining tighter controls on overall water use. Tables A-3 through A-5, in Attachment 2-1, summarize the projected water demands through the year 2060 as adopted by the RWPG with all revisions being approved by the Texas Water Development Board.

2.2 Population Growth

The Region B projected total population growth is shown in Figure 2-1. The projections were determined by:

- Using the latest information published by the State Data Center for city populations;
- Surveying the cities, smaller communities, rural water supply corporations, municipal utility districts, and river authorities to determine population based on existing meter counts;
- Using growth trends derived from the surveys based on populations and meter counts from 1990 to 2000.

Figure 2-1

Projected Population for Region B

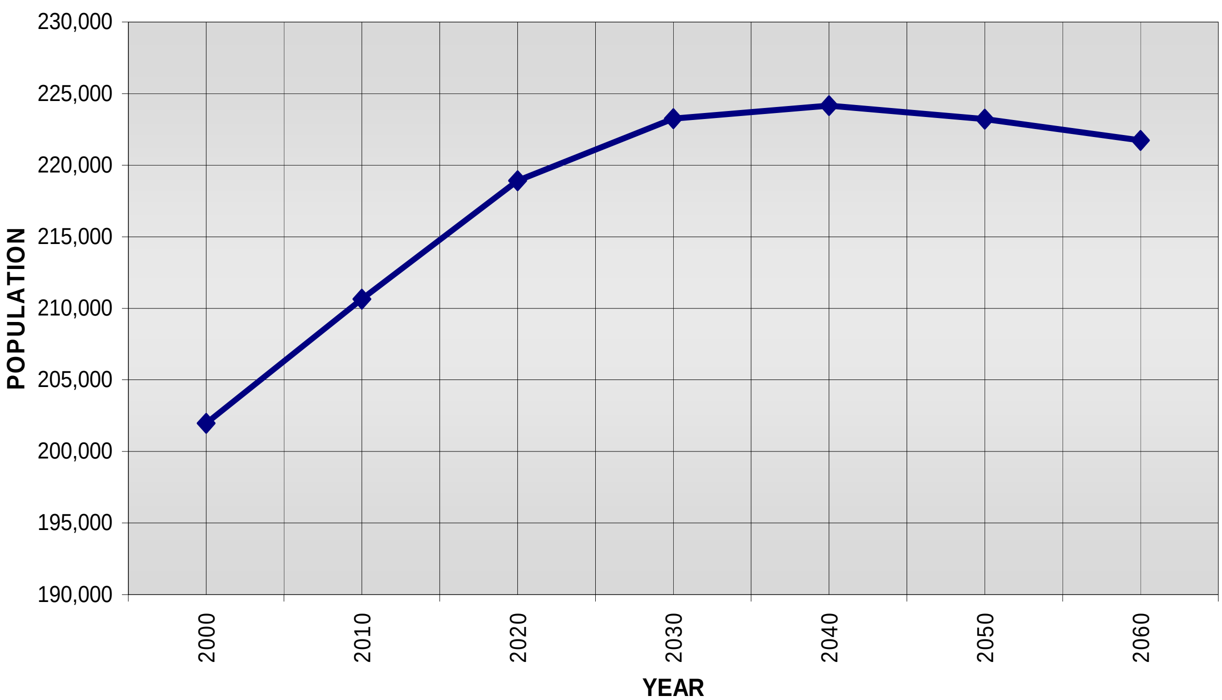


Table 2-1

Projected Population Data Points

YEAR	2000	2010	2020	2030	2040	2050	2060
POPULATION	201,970	210,642	218,918	223,251	224,165	223,215	221,734

The city with the highest projected growth rate is Wichita Falls. It is expected to grow by approximately 17 percent in the next sixty years for several reasons. Recently the city annexed additional property north and west of town. The Allred Prison has expanded and Midwestern State University student population has increased in recent years. Other towns that may experience some growth include Lakeside City, Henrietta, Burkburnett, Iowa Park, and Vernon.

2.3 Water Uses

2.3.1 Total Region B Use

The water use for Region B has been divided into several categories for analysis purposes. The various uses analyzed include water for municipal use (MUN), industrial or manufacturing (MFG), power cooling (PWR), mining (MIN), agricultural irrigation (IRR), and livestock watering (STK). Figure 2-2 shows the amounts of water predicted to be required for these categories through the year 2060. The water use is shown in acre-feet per year (Ac-Ft/Yr.) units with one acre-foot being equivalent to 325,851 gallons of water.

Figure 2-2

Projected Water Use for Region B

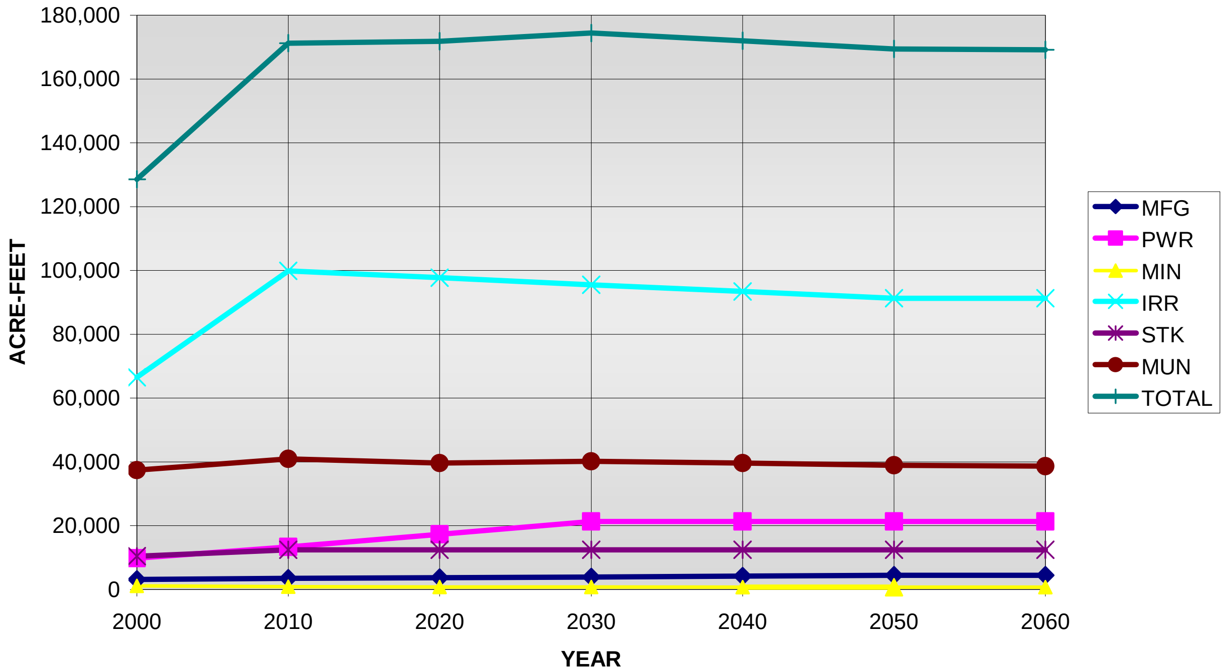


Table 2-2

Projected Water Use Data Points (Acre-Feet/Yr.)

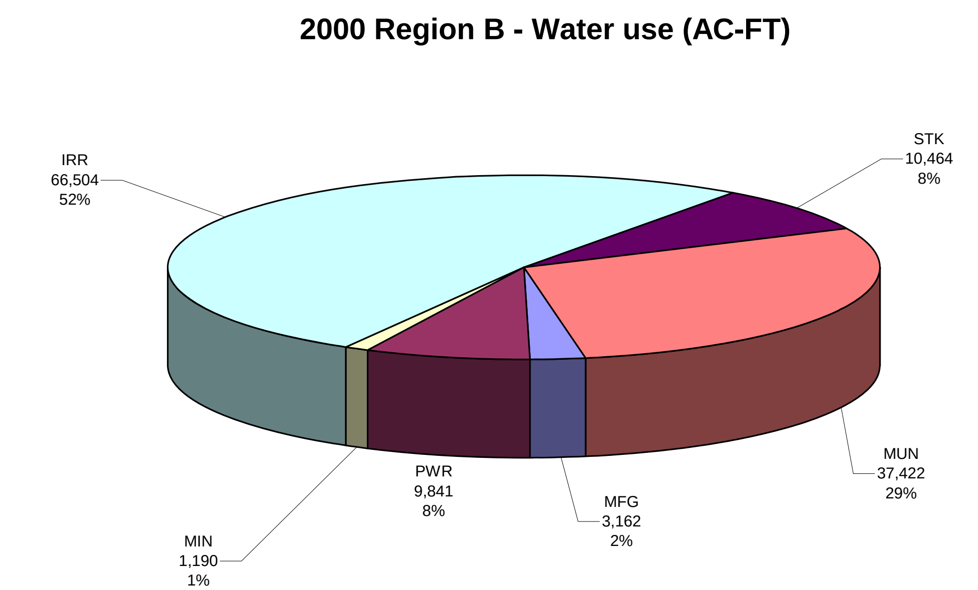
YEAR	2000	2010	2020	2030	2040	2050	2060
MFG	3,162	3,547	3,755	3,968	4,260	4,524	4,524
PWR	9,841	13,360	17,360	21,360	21,360	21,360	21,360
MIN	1,190	909	845	811	785	792	792
IRR	66,504	99,895	97,702	95,537	93,400	91,292	91,292
STK	10,464	12,489	12,489	12,489	12,489	12,489	12,489
MUN	37,422	40,964	39,655	40,196	39,664	38,962	38,696
TOTAL	128,583	171,164	171,806	174,361	171,958	169,419	169,153

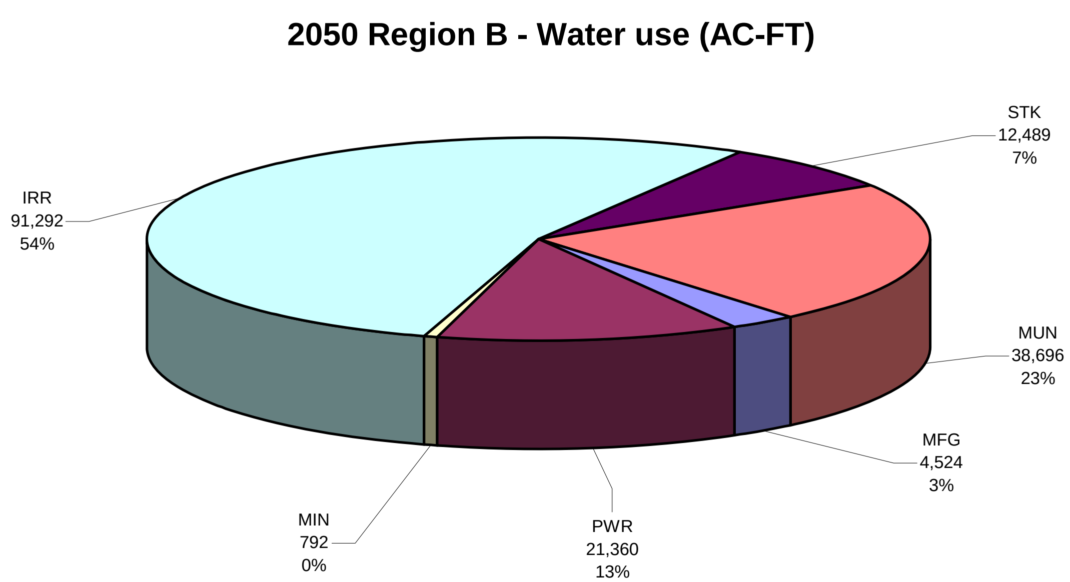
Total water consumption for the region is predicted to remain approximately level from 2000 to 2060. Figure 2-3 compares the water uses of 2000 to the projected water uses for 2060.

The two scenarios in Figure 2-3 show that the composition of water use for this region is not anticipated to change much.

Figure 2-3

Composition of Past and Projected Region B Water Use





2.3.2 Municipal Water Use

Municipal water use is defined by the TWDB as residential and commercial water use. Residential use includes single and multi-family household water use. Commercial use includes water used by business establishments, public offices, and institutions, but does not include industrial water use. Residential and commercial water uses are categorized together because they are similar types of uses, for example, each category uses water primarily for drinking, cleaning, sanitation, cooling and landscape watering.

Water use data were compiled for the water users of the region through research of records at the TWDB, the TCEQ, and through questionnaires sent to the providers of municipal water.

The total municipal water use for Region B is shown to decline from 40,964 Ac-Ft in the year 2010 to 38,696 Ac-Ft in 2060 in spite of a population increase of nearly 10 percent. The decrease is anticipated because, as previously mentioned, the per capita water use is expected to decrease over the next sixty years. Decreases in water use are expected due to water savings from more efficient plumbing fixtures as required by the State Plumbing Code.

2.3.3 Manufacturing Water Use

Manufacturing, or industrial, water use has been defined as water used in the production process of manufactured products, including water used by employees for drinking and sanitation purposes. Water use for manufacturing products (MFG) in Region B is a small percentage, approximately 3 percent, of the overall water use in this region.

The majority of the MFG water use is in Wichita County by the industrial facilities in and around Wichita Falls. Over 66 percent of the MFG water for the region is consumed in Wichita County. Wilbarger, Hardeman, and Montague Counties also have facilities that require water in the MFG category. The top six MFG facilities in Wichita County include: Vetrotex America, PPG Industries, Stanley Proto Tools, Howmet Corporation, Wichita Falls Castings, and Tranter Inc. Wilbarger County has Rhodia Inc. and Wright Brand Foods as the major industrial users for that area. There are numerous other small industrial users in Region B.

Based on the increasing trend of water required for MFG in Region B, an increase from 3,162 Ac-Ft in 2000 to 4,524 Ac-Ft in 2060 has been projected, for a 38 percent increase in this category. Figure 2-4 shows the projections for manufacturing water use in Region B.

Region B will probably have some growth in the number of industrial facilities that locate in the area. The anticipated growth can be attributed to reasonable land prices, a good labor market, and above average power and water resources.

Figure 2-4

Projected Industrial Water Use for Region B

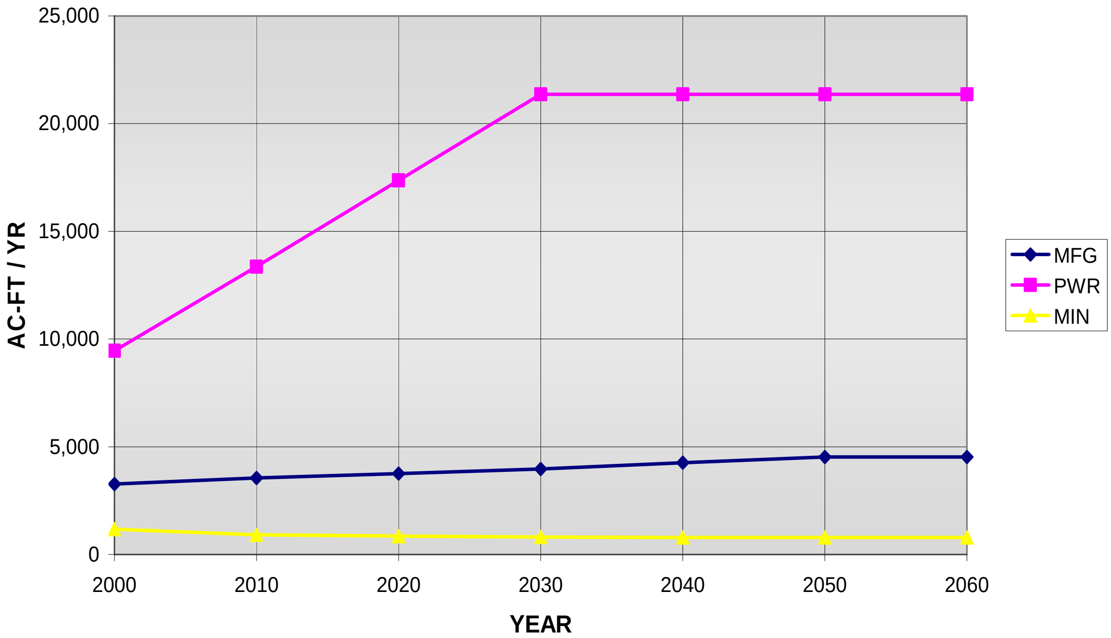


Table 2-3

Projected Industrial Water Use Data Points

YEAR	2000	2010	2020	2030	2040	2050	2060
MFG	3,162	3,547	3,755	3,968	4,260	4,524	4,524
PWR	9,841	13,360	17,360	21,360	21,360	21,360	21,360
MIN	1,190	909	845	811	785	792	792

2.3.4 Steam-Electric Power Generation

The total water use required for steam-electric power generation for Region B was 9,841 Ac-Ft in the year 2000 and is expected to grow to 21,360 Ac-Ft in the year 2060. American Electric Power (AEP) currently has a power producing plant in Wilbarger County and AEP formerly owned a facility in Hardeman County. The Hardeman County Facility has been sold and is currently not being used for electric generation, however, it may resume power generation in the future and the demands are included in this update. With possible future expansion of the AEP facilities, the water used in this category is expected to increase over the sixty year planning period. The percentage of water used for power generation in Region B will increase from eight percent in 2000 to 13 percent in 2060. The projections for water use for steam-electric power generation are also shown in Figure 2-4.

2.3.5 Mining Water Use

The oil and gas industry has played a large role in the history and development of the North Central Texas area and is essentially the only "mining" activity in the region. Fresh water has been used in the past to drill wells and in some cases to water flood oil fields. However, as the fields in this area are mature and will not see much more development, water required for production will decline as well. Based on current status of the oil industry and recent trends in water required for mining in this region, a decrease from 1,190 Ac-Ft required in the year 2000 to 792 Ac-Ft in the year 2060 is projected and is shown in Figure 2-4.

2.3.6 Agricultural Irrigation Water Use

The largest water use in Region B is irrigated agriculture. Irrigated crops in the region include cotton, wheat, peanuts, alfalfa, hay-pasture, vegetables, orchards, and others. The total acreage irrigated varies from year to year depending on weather, crop price, government programs, and other factors. Agricultural irrigation use accounted for approximately 52 percent of the water used in 2000 and is projected to be 54 percent of all the water used in 2060. Figure 2-5 shows the projected agricultural irrigation water use.

A portion of the water used for irrigation in Region B is from groundwater, but the majority of the water used is surface water, which is delivered through unlined open canals and distribution laterals. The existing canal system is known to have large water losses due to overflows out the end of many of the laterals. These water losses have been included in the water required for irrigation.

Figure 2-5

Projected Agricultural Water Use for Region B

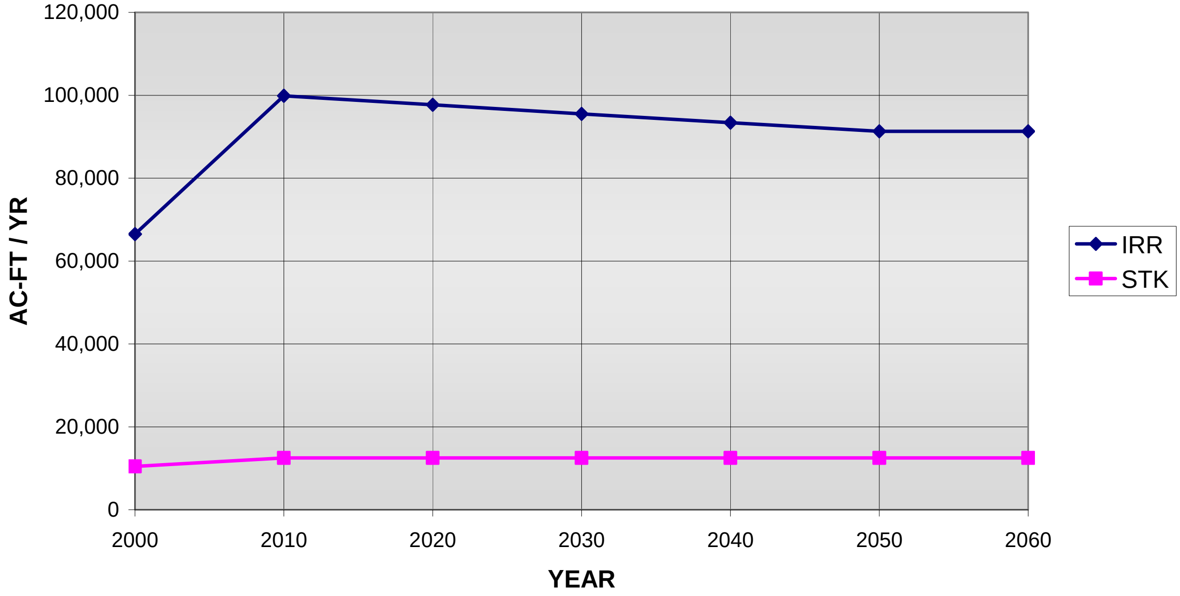


Table 2-4

Projected Agricultural Water Use Data Points

YEAR	2000	2010	2020	2030	2040	2050	2060
IRR	66,504	99,895	97,702	95,537	93,400	91,292	91,292
STK	10,464	12,489	12,489	12,489	12,489	12,489	12,489

2.3.7 Livestock Watering

Livestock production is an important part of the economy in Region B. In 2000, the total water used in the region for livestock was 10,464 Ac-Ft, and the use is projected slightly increase through 2060. The livestock water use projections are shown in Figure 2-5.

2.3.8 Wholesale Water Providers

The only Wholesale Water Provider (WWP) in Region B is the City of Wichita Falls. Shown in Table 2-5 below are the demands for 2010 through 2060 on the Wichita Falls system.

Table 2-5

Wichita Falls Wholesale Water Demand

CUSTOMERS	Contract (MGD)	Demands (Acre-Feet per Year)					
		2010	2020	2030	2040	2050	2060
Wichita Falls		27,659	26,418	27,372	27,292	27,240	27,449
Archer City	0.60	336	336	336	336	336	336
Archer Co. Mud #1	0.15	84	84	84	84	84	84
Holliday		299	310	319	320	306	295
Lakeside City	0.35	196	196	196	196	196	196
Scotland	0.25	140	140	140	140	140	140
Windthorst WSC	0.75	420	420	420	420	420	420
Dean Dale WSC (Clay County)	0.825	292	286	280	271	263	253
Red River Authority	0.75	420	420	420	420	420	420
Burkburnett	3.30	1,850	1,850	1,850	1,850	1,850	1,850
Dean Dale WSC (Wichita County)	(above)	170	176	182	191	199	209
Friberg Cooper WSC	0.25	140	140	140	140	140	140
Iowa Park	5.20	2.915	2.915	2.915	2.915	2.915	2.915
Pleasant Valley		120	114	112	109	108	107
Wichita Valley WSC	1.85	1,037	1,037	1,037	1,037	1,037	1,037
Olney	1.00	561	561	561	561	561	561
Manufacturing		1,736	1,831	1,919	2,027	2,111	2,111
Steam Electric		360	360	360	360	360	360
Total Demand		**38,735**	**37,593**	**38,642**	**38,669**	**38,686**	**38,882**

NOTE: Wholesale water provider water use by county and river basin is shown in Attachment 2-1.

2.3.9 Region B Water Plan

This chapter has been updated in accordance with the Texas Water Development Board requirements and all updated population and water use projections were adopted by the Region B RWPG in 2009.

ATTACHMENT 2-1

REGIONAL WATER PLANNING GROUP B

POPULATION TABLES A-1 AND A-2
WATER USE TABLES A-3 THROUGH A-5

REGION B WATER PLAN UPDATE
TABLE A-1
PROJECTED TOTAL POPULATION OF REGION B

CITY	COUNTY	RIVER BASIN	1990 POP.	2000 POP.	2010 POP.	2020 POP.	2030 POP.	2040 POP.	2050 POP.	2060 POP.
Archer City	Archer	RED	1,784	1,848	2,022	2,200	2,345	2,390	2,307	2,223
Holliday	Archer	RED	1,475	1,632	1,786	1,943	2,071	2,110	2,038	1,963
Lakeside City	Archer	RED	865	984	1,077	1,172	1,249	1,272	1,228	1,183
Seymour	Baylor	BRAZOS	3,185	2,908	2,692	2,569	2,378	2,206	2,089	1,933
Byers	Clay	RED	510	517	534	550	546	524	491	459
Henrietta	Clay	RED	2,896	3,264	3,374	3,470	3,448	3,306	3,103	2,900
Petrolia	Clay	RED	762	782	808	831	826	792	743	695
Paducah	Cottle	RED	1,788	1,498	1,458	1,455	1,384	1,304	1,233	1,193
Crowell	Foard	RED	1,230	1,141	1,137	1,145	1,121	1,081	1,055	1,017
Chillicothe	Hardeman	RED	816	798	796	795	791	786	780	769
Quanah	Hardeman	RED	3,413	3,022	2,981	2,954	2,863	2,746	2,617	2,371
Guthrie	King	RED	150	150	152	144	124	98	77	75
Bowie	Montague	TRINITY	4,990	5,219	5,305	5,389	5,423	5,436	5,440	5,449
Montague	Montague	RED	490	479	470	460	440	421	401	395
Nocona	Montague	RED	2,870	3,198	3,321	3,442	3,491	3,510	3,515	3,528
Saint Jo	Montague	TRINITY	1,048	898	898	898	898	898	898	898
Burkburnett	Wichita	RED	10,145	10,927	11,465	11,949	12,269	12,436	12,553	12,647
Electra	Wichita	RED	3,113	3,168	3,206	3,240	3,263	3,275	3,283	3,290
Iowa Park	Wichita	RED	6,072	6,431	6,678	6,900	7,047	7,124	7,178	7,221
Wichita Falls	Wichita	RED	96,259	104,197	109,663	114,576	117,825	119,525	120,710	121,668
Vernon	Wilbarger	RED	12,001	11,660	12,139	12,655	12,706	12,451	11,844	11,144
Olney	Young	BRAZOS	3,519	3,396	3,429	3,504	3,509	3,469	3,418	3,386
Other Rural			31,514	33,853	35,251	36,677	37,234	37,005	36,214	35,327
Total			**190,895**	**201,970**	**210,642**	**218,918**	**223,251**	**224,165**	**223,215**	**221,734**

REGION B WATER PLAN UPDATE
TABLE A-2
PROJECTED "COUNTY OTHER" POPULATION OF REGION B

CITY	COUNTY	RIVER BASIN	1990 POP.	2000 POP.	2010 POP.	2020 POP.	2030 POP.	2040 POP.	2050 POP.	2060 POP.
Baylor WSC	Archer	RED	76	93	103	113	120	130	140	140
Archer Co. MUD #1	Archer	RED	500	727	944	1,000	1,035	1,035	1,035	1,025
Megargel	Archer	RED	223	226	300	300	300	300	244	225
Scotland	Archer	RED	500	600	714	714	815	815	765	700
Windthorst WSC	Archer	RED	800	1,157	1,266	1,378	1,468	1,496	1,444	1,392
Wichita Valley WSC	Archer	RED	1,050	2,736	2,994	3,258	3,472	3,538	3,416	3,291
Archer Co. Other	Archer	RED	650	200	140	150	250	300	200	180
Archer Co. Other	Archer	TRINITY	25	100	80	60	102	137	137	135
Archer Co. Other	Archer	BRAZOS	25	76	100	64	100	100	100	100
County Total			**3,849**	**5,915**	**6,641**	**7,037**	**7,662**	**7,851**	**7,481**	**7,188**
Baylor WSC	Baylor	BRAZOS	474	830	880	920	960	970	980	990
Baylor Co. Other	Baylor	RED	219	106	50	50	50	50	50	50
Baylor Co. Other	Baylor	BRAZOS	507	249	243	196	146	127	111	93
County Total			**1,200**	**1,185**	**1,173**	**1,166**	**1,156**	**1,147**	**1,141**	**1,133**
Bellevue	Clay	RED	349	349	349	349	320	310	300	300
Blue Grove WSC	Clay	RED	95	95	95	95	90	85	80	80
Charlie WSC	Clay	RED	80	90	90	90	90	90	90	90
Dean Dale WSC	Clay	RED	1,988	2,081	2,151	2,212	2,199	2,108	1,978	1,849
Arrowhead Lake System	Clay	RED	713	712	712	711	710	709	709	710
Arrowhead Ranch System	Clay	RED	568	588	608	613	618	623	633	635
Windthorst WSC	Clay	RED		220	227	234	232	223	209	195
Friberg-Cooper WSC	Clay	RED	234	244	254	260	260	260	260	260
Clay Co. Other	Clay	RED	1,265	1,617	1,712	1,809	1,817	1,664	1,441	1,208
Clay Co. Other	Clay	TRINITY	564	447	462	475	472	453	425	397
County Total			**5,856**	**6,443**	**6,660**	**6,848**	**6,808**	**6,525**	**6,125**	**5,724**
King-Cottle WSC	Cottle	RED	422	376	369	368	360	345	332	325
Cottle Co. Other	Cottle	RED	37	30	30	30	25	25	25	25
County Total			**459**	**406**	**399**	**398**	**385**	**370**	**357**	**350**
Foard Co. System	Foard	RED	100	105	105	105	105	105	105	100
Margaret System	Foard	RED	90	85	85	85	80	75	70	65
Thalia WSC	Foard	RED	195	190	190	190	185	180	175	170
Foard Co. Other	Foard	RED	179	101	97	105	93	66	52	32
County Total			**564**	**481**	**477**	**485**	**463**	**426**	**402**	**367**

REGION B WATER PLAN UPDATE
TABLE A-2 (Continued)
PROJECTED "COUNTY OTHER" POPULATION OF REGION B

CITY	COUNTY	RIVER BASIN	1990 POP.	2000 POP.	2010 POP.	2020 POP.	2030 POP.	2040 POP.	2050 POP.	2060 POP.
Goodlett System	Hardeman	RED	103	101	100	100	100	100	100	95
Medicine Mound System	Hardeman	RED	100	111	106	106	106	106	106	100
Quanah NE System	Hardeman	RED	208	207	207	207	207	207	207	200
S Quanah System	Hardeman	RED	70	75	75	75	75	75	75	70
Hardeman Co. Other	Hardeman	RED	573	410	400	389	354	309	259	187
County Total			**1,054**	**904**	**888**	**877**	**842**	**797**	**747**	**652**
King-Cottle WSC	King	RED	110	110	115	120	120	120	125	125
Dumont System	King	RED	60	60	70	85	85	85	85	85
King Co. Other	King	RED	12	16	28	55	85	76	72	37
King Co. Other	King	BRAZOS	22	20	20	20	10	10	10	10
County Total			**204**	**206**	**233**	**280**	**300**	**291**	**292**	**257**
Forestburg	Montague	TRINITY	141	160	170	180	185	190	195	200
Montague System	Montague	RED	393	400	400	400	410	410	420	425
Nocona Hills WSC	Montague	RED	607	800	1,200	1,300	1,400	1,500	1,600	1,700
Oak Shores System	Montague	RED	300	400	500	500	600	600	700	700
Sunset System	Montague	TRINITY	335	400	400	450	450	450	500	500
Ringgold WSC	Montague	RED	215	300	300	350	350	350	350	350
Montague Co. Other	Montague	RED	1,896	1,552	1,290	1,295	1,202	1,203	1,204	1,204
Montague Co. Other	Montague	TRINITY	3,989	3,786	3,771	4,122	3,953	3,867	3,817	3,862
County Total			**7,876**	**7,798**	**8,032**	**8,597**	**8,550**	**8,570**	**8,786**	**8,941**
Friberg Cooper WSC	Wichita	RED	336	346	360	370	380	380	380	380
Horseshoe Bend System	Wichita	RED	70	70	70	70	70	70	70	70
Pleasant Valley	Wichita	RED	435	460	480	480	480	480	480	480
Wichita Valley WSC	Wichita	RED	3,032	2,764	3,159	3,514	3,749	3,872	3,958	4,027
Dean Dale WSC	Wichita	RED	497	1,121	1,248	1,362	1,438	1,478	1,506	1,528
Wichita Co. Other	Wichita	RED	2,419	2,180	1,729	1,344	1,085	955	863	791
County Total			**6,789**	**6,941**	**7,046**	**7,140**	**7,202**	**7,235**	**7,257**	**7,276**
Box Com. System	Wilbarger	RED	143	143	142	142	142	142	142	150
Farmers Valley System	Wilbarger	RED	103	102	102	101	101	100	100	110
Harrold WSC	Wilbarger	RED	222	222	222	222	222	222	222	225
Hinds Com. System	Wilbarger	RED	128	128	127	127	127	127	127	135
Lockett System	Wilbarger	RED	585	596	603	603	603	603	603	615
Northside WSC	Wilbarger	RED	138	138	138	138	138	138	138	145
Odell System	Wilbarger	RED	106	110	110	110	110	110	110	115
Oklaunion WSC	Wilbarger	RED	320	320	320	320	320	320	320	325
Wilbarger Co. Other	Wilbarger	RED	1,375	1,257	1,376	1,510	1,524	1,459	1,302	1,063
County Total			**3,120**	**3,016**	**3,140**	**3,273**	**3,287**	**3,221**	**3,064**	**2,883**

REGION B WATER PLAN UPDATE
TABLE A-2 (Continued)
PROJECTED "COUNTY OTHER" POPULATION OF REGION B

CITY	COUNTY	RIVER BASIN	1990 POP.	2000 POP.	2010 POP.	2020 POP.	2030 POP.	2040 POP.	2050 POP.	2060 POP.
Young Co. Other	Young	BRAZOS	537	552	557	570	570	564	556	550
Young Co. Other	Young	TRINITY	6	6	5	6	9	8	6	6
County Total			**543**	**558**	**562**	**576**	**579**	**572**	**562**	**556**

TABLE A-3
PROJECTED TOTAL MUNICIPAL WATER USE OF REGION B
PLAN UPDATE

USER	COUNTY	RIVER	DATA	2000	2010	2020	2030	2040	2050	2060
		BASIN	CAT.	Water Use	DEMAND	DEMAND	DEMAND	DEMAND	DEMAND	DEMAND
				AF/YR	AF/YR	AF/YR	AF/YR	AF/YR	AF/YR	AF/YR
Archer City	Archer	RED	MUN	232	333	343	356	357	341	328
Holliday	Archer	RED	MUN	245	249	258	266	267	255	246
Lakeside City	Archer	RED	MUN	125	166	163	173	169	161	155
Seymour	Baylor	BRAZOS	MUN	554	611	548	504	460	432	387
Byers	Clay	RED	MUN	69	83	81	78	73	64	64
Henrietta	Clay	RED	MUN	526	720	701	677	638	592	553
Petrolia	Clay	RED	MUN	93	95	92	90	84	73	73
Paducah	Cottle	RED	MUN	247	316	300	277	256	239	232
Crowell	Foard	RED	MUN	250	277	264	252	241	233	224
Chillicothe	Hardeman	RED	MUN	151	117	109	106	102	100	98
Quanah	Hardeman	RED	MUN	565	543	510	491	453	426	386
Guthrie	King	RED	MUN	77	68	65	56	44	35	34
Bowie	Montague	TRINITY	MUN	824	1,027	987	966	952	941	943
Montague	Montague	RED	MUN	55	47	46	44	42	40	39
Nocona	Montague	RED	MUN	484	693	681	671	664	657	660
Saint Jo	Montague	TRINITY	MUN	210	99	101	98	97	96	96
Burkburnett	Wichita	RED	MUN	1,273	1,843	1,820	1,816	1,809	1,806	1,819
Electra	Wichita	RED	MUN	337	575	550	539	531	526	527
Iowa Park	Wichita	RED	MUN	1,232	1,210	1,184	1,176	1,169	1,163	1,170
Wichita Falls	Wichita	RED	MUN	21,942	23,049	22,015	22,810	22,743	22,700	22,874
Vernon	Wilbarger	RED	MUN	2,795	2,671	2,659	2,627	2,519	2,383	2,229
Olney	Young	BRAZOS	MUN	609	707	685	667	647	631	625
Other Rural				5,508	5,465	5,493	5,456	5,347	5,068	4,934
TOTAL				**37,422**	**40,964**	**39,655**	**40,196**	**39,664**	**38,962**	**38,696**

TABLE A-4
PROJECTED "COUNTY OTHER" WATER USE OF REGION B
PLAN UPDATE

USER	COUNTY	RIVER	DATA	2000	2010	2020	2030	2040	2050	2060
		BASIN	CAT.	Water Use	DEMAND	DEMAND	DEMAND	DEMAND	DEMAND	DEMAND
				AF/YR	AF/YR	AF/YR	AF/YR	AF/YR	AF/YR	AF/YR
Baylor WSC	Archer	RED	MUN	18	21	21	21	21	21	21
Archer Co. MUD #1	Archer	RED	MUN	138	150	150	151	149	147	146
Megargel	Archer	RED	MUN	46	42	40	39	39	31	32
Scotland	Archer	RED	MUN	224	226	214	208	237	216	212
Windthorst WSC	Archer	RED	MUN	351	198	205	203	202	199	196
Wichita Valley WSC	Archer	RED	MUN	184	347	356	351	343	329	316
Archer Co. Other	Archer	RED	MUN	33	24	22	37	42	28	25
Archer Co. Other	Archer	TRINITY	MUN	24	20	8	10	14	14	14
Archer Co. Other	Archer	BRAZOS	MUN	36	30	10	33	23	23	23
COUNTY TOTAL				**1,210**	**1,058**	**1,026**	**1,053**	**1,070**	**1,008**	**985**
Baylor WSC	Baylor	BRAZOS	MUN	190	187	190	190	190	190	192
Baylor Co. - Other	Baylor	RED	MUN	22	17	15	13	13	12	12
Baylor Co. - Other	Baylor	BRAZOS	MUN	90	73	59	26	23	20	17
COUNTY TOTAL				**302**	**277**	**264**	**229**	**226**	**222**	**221**
Bellevue	Clay	RED	MUN	41	38	38	38	38	38	38
Bluegrove WSC	Clay	RED	MUN	7	7	7	7	7	7	7
Charlie WSC	Clay	RED	MUN	10	10	9	9	9	9	9
Dean Dale WSC	Clay	RED	MUN	217	230	224	218	206	199	192
Windthorst WSC	Clay	RED	MUN	67	36	35	32	30	29	27
Arrowhead Lake System	Clay	RED	MUN	95	90	85	83	81	80	81
Arrowhead Ranch System	Clay	RED	MUN	89	87	84	82	81	81	83
Friberg-Cooper WSC	Clay	RED	MUN	78	81	83	83	83	83	83
Clay Co. Other	Clay	RED	MUN	508	532	534	525	467	317	251
Clay Co. Other	Clay	TRINITY	MUN	68	69	63	66	50	47	44
COUNTY TOTAL				**1,180**	**1,180**	**1,162**	**1,143**	**1,052**	**890**	**815**
King-Cottle WSC	Cottle	RED	MUN	75	74	74	72	69	67	65
Cottle Co. Other	Cottle	RED	MUN	6	5	2	4	4	4	4
COUNTY TOTAL				**81**	**79**	**76**	**76**	**73**	**71**	**69**
Foard Co. System	Foard	RED	MUN	49	47	44	43	42	42	40
Margaret System	Foard	RED	MUN	17	17	17	16	15	14	13
Thalia WSC	Foard	RED	MUN	34	34	34	33	32	31	30
Foard Co. Other	Foard	RED	MUN	22	18	19	18	13	10	6
COUNTY TOTAL				**122**	**116**	**114**	**110**	**102**	**97**	**89**

TABLE A-4 (Continued)
PROJECTED "COUNTY OTHER" WATER USE OF REGION B
PLAN UPDATE

USER	COUNTY	RIVER	DATA	2000	2010	2020	2030	2040	2050	2060
		BASIN	CAT.	Water Use	DEMAND	DEMAND	DEMAND	DEMAND	DEMAND	DEMAND
				AF/YR	AF/YR	AF/YR	AF/YR	AF/YR	AF/YR	AF/YR
Goodlett System	Hardeman	RED	MUN	17	16	15	14	13	13	12
Medicine Mound System	Hardeman	RED	MUN	19	17	16	15	15	15	14
Quanah NE System	Hardeman	RED	MUN	59	56	53	51	50	50	49
S Quanah System	Hardeman	RED	MUN	19	18	17	16	16	16	15
Hardeman Co. Other	Hardeman	RED	MUN	74	65	63	57	50	42	30
COUNTY TOTAL				**188**	**172**	**164**	**153**	**144**	**136**	**120**
King-Cottle WSC	King	RED	MUN	17	17	18	18	18	19	19
Dumont System	King	RED	MUN	30	35	43	43	43	43	43
King Co. Other	King	RED	MUN	2	4	8	13	11	11	6
King Co. Other	King	BRAZOS	MUN	3	3	3	1	1	1	1
COUNTY TOTAL				**52**	**59**	**72**	**75**	**73**	**74**	**69**
Forestburg	Montague	RED	MUN	24	26	27	28	29	30	31
Montague WSC	Montague	RED	MUN	32	32	32	33	33	34	35
Nocona Hills WSC	Montague	RED	MUN	96	144	156	168	180	192	204
Oak Shores System	Montague	RED	MUN	5	6	6	7	7	9	9
Sunset System	Montague	RED	MUN	20	20	22	22	22	25	25
Ringgold WSC	Montague	RED	MUN	24	24	25	25	25	25	25
Montague Co. Other	Montague	RED	MUN	201	167	168	156	156	156	156
Montague Co. Other	Montague	TRINITY	MUN	796	735	797	811	815	795	792
COUNTY TOTAL				**1198**	**1,154**	**1,233**	**1,250**	**1,267**	**1,266**	**1,277**
Friberg Cooper WSC	Wichita	RED	MUN	92	110	119	119	119	119	119
Horseshoe Bend System	Wichita	RED	MUN	14	14	14	14	14	14	14
Pleasant Valley	Wichita	RED	MUN	101	100	95	93	91	90	90
Wichita Valley WSC	Wichita	RED	MUN	186	366	385	378	375	381	386
Dean Dale WSC	Wichita	RED	MUN	117	134	138	142	145	151	158
Wichita Co. Other	Wichita	RED	MUN	109	164	185	53	44	25	13
COUNTY TOTAL				**619**	**807**	**809**	**799**	**788**	**780**	**780**
Box Com. System	Wilbarger	RED	MUN	19	18	17	17	16	16	17
Farmers Valley System	Wilbarger	RED	MUN	23	22	21	20	19	19	21
Harold WSC	Wilbarger	RED	MUN	29	28	27	27	26	26	28
Hinds Com. System	Wilbarger	RED	MUN	26	25	23	23	22	22	25
Lockett System	Wilbarger	RED	MUN	95	91	87	84	83	82	85
Northside WSC	Wilbarger	RED	MUN	37	35	33	32	32	31	35
Odell System	Wilbarger	RED	MUN	16	15	15	14	14	14	17
Oklaunion WSC	Wilbarger	RED	MUN	40	39	37	35	35	35	38
Wilbarger Co. Other	Wilbarger	RED	MUN	188	206	226	229	219	195	160
COUNTY TOTAL				**473**	**479**	**486**	**481**	**466**	**440**	**426**
Young Co. Other	Young	BRAZOS	MUN	82	83	86	86	85	83	82
Young Co. Other	Young	TRINITY	MUN	1	1	1	1	1	1	1
COUNTY TOTAL				**83**	**84**	**87**	**87**	**86**	**84**	**83**
GRAND TOTAL (COUNTY OTHER)				**5,508**	**5,465**	**5,493**	**5,456**	**5,347**	**5,068**	**4,934**

TABLE A-5
PROJECTED "NON-MUNICIPAL" WATER USE OF REGION B
PLAN UPDATE

COUNTY	RIVER	DATA	2000	2010	2020	2030	2040	2050	2060
	BASIN	CAT.	Water Use	DEMAND	DEMAND	DEMAND	DEMAND	DEMAND	DEMAND
			AF/YR	AF/YR	AF/YR	AF/YR	AF/YR	AF/YR	AF/YR
ARCHER	RED	MFG	0	0	0	0	0	0	0
ARCHER	RED	PWR	0	0	0	0	0	0	0
ARCHER	RED	MIN	0	0	0	0	0	0	0
ARCHER	RED	IRR	1,971	3,500	3,400	3,300	3,200	3,100	3,100
ARCHER	RED	STK	2,165	2,277	2,277	2,277	2,277	2,277	2,277
ARCHER	TRINITY	MFG	0	0	0	0	0	0	0
ARCHER	TRINITY	PWR	0	0	0	0	0	0	0
ARCHER	TRINITY	MIN	0	0	0	0	0	0	0
ARCHER	TRINITY	IRR	0	0	0	0	0	0	0
ARCHER	TRINITY	STK	284	298	298	298	298	298	298
ARCHER	BRAZOS	MFG	0	0	0	0	0	0	0
ARCHER	BRAZOS	PWR	0	0	0	0	0	0	0
ARCHER	BRAZOS	MIN	0	0	0	0	0	0	0
ARCHER	BRAZOS	IRR	0	0	0	0	0	0	0
ARCHER	BRAZOS	STK	129	136	136	136	136	136	136
BAYLOR	RED	MFG	0	0	0	0	0	0	0
BAYLOR	RED	PWR	0	0	0	0	0	0	0
BAYLOR	RED	MIN	0	0	0	0	0	0	0
BAYLOR	RED	IRR	213	198	193	187	181	176	176
BAYLOR	RED	STK	629	600	600	600	600	600	600
BAYLOR	BRAZOS	MFG	0	0	0	0	0	0	0
BAYLOR	BRAZOS	PWR	0	0	0	0	0	0	0
BAYLOR	BRAZOS	MIN	39	21	10	5	0	0	0
BAYLOR	BRAZOS	IRR	523	487	473	459	445	431	431
BAYLOR	BRAZOS	STK	370	353	353	353	353	353	353
CLAY	RED	MFG	0	0	0	0	0	0	0
CLAY	RED	PWR	0	0	0	0	0	0	0
CLAY	RED	MIN	306	219	195	180	176	176	176
CLAY	RED	IRR	1,993	3,900	3,800	3,700	3,600	3,500	3,500
CLAY	RED	STK	1,741	1,972	1,972	1,972	1,972	1,972	1,972
CLAY	TRINITY	MFG	0	0	0	0	0	0	0
CLAY	TRINITY	PWR	0	0	0	0	0	0	0
CLAY	TRINITY	MIN	4	3	3	4	4	4	4
CLAY	TRINITY	IRR	0	0	0	0	0	0	0
CLAY	TRINITY	STK	194	219	219	219	219	219	219
COTTLE	RED	MFG	0	0	0	0	0	0	0
COTTLE	RED	PWR	0	0	0	0	0	0	0
COTTLE	RED	MIN	25	25	27	28	30	30	30
COTTLE	RED	IRR	4,434	4,301	4,172	4,047	3,925	3,808	3,808
COTTLE	RED	STK	387	387	387	387	387	387	387
FOARD	RED	MFG	0	0	0	0	0	0	0
FOARD	RED	PWR	0	0	0	0	0	0	0
FOARD	RED	MIN	22	24	24	25	26	27	27
FOARD	RED	IRR	3,889	4,829	4,684	4,543	4,407	4,275	4,275
FOARD	RED	STK	279	289	289	289	289	289	289
HARDEMAN	RED	MFG	23	374	398	424	452	480	480
HARDEMAN	RED	PWR	879	1,000	1,000	1,000	1,000	1,000	1,000
HARDEMAN	RED	MIN	111	3	3	2	2	2	2
HARDEMAN	RED	IRR	5,330	4,849	4,704	4,563	4,426	4,293	4,293
HARDEMAN	RED	STK	480	480	480	480	480	480	480

TABLE A-5 (Continued)
PROJECTED "NON-MUNICIPAL" WATER USE OF REGION B
PLAN UPDATE

COUNTY	RIVER	DATA	2000	2010	2020	2030	2040	2050	2060
	BASIN	CAT.	Water Use	DEMAND	DEMAND	DEMAND	DEMAND	DEMAND	DEMAND
			AF/YR	AF/YR	AF/YR	AF/YR	AF/YR	AF/YR	AF/YR
KING	RED	MFG	0	0	0	0	0	0	0
KING	RED	PWR	0	0	0	0	0	0	0
KING	RED	MIN	0	0	0	0	0	0	0
KING	RED	IRR	20	20	20	20	20	20	20
KING	RED	STK	244	486	486	486	486	486	486
KING	BRAZOS	MFG	0	0	0	0	0	0	0
KING	BRAZOS	PWR	0	0	0	0	0	0	0
KING	BRAZOS	MIN	0	0	0	0	0	0	0
KING	BRAZOS	IRR	0	0	0	0	0	0	0
KING	BRAZOS	STK	143	285	285	285	285	285	285
MONTAGUE	RED	MFG	6	9	12	15	19	24	24
MONTAGUE	RED	PWR	0	0	0	0	0	0	0
MONTAGUE	RED	MIN	609	491	467	459	463	476	476
MONTAGUE	RED	IRR	12	59	59	59	59	59	59
MONTAGUE	RED	STK	856	1,054	1,054	1,054	1,054	1,054	1,054
MONTAGUE	TRINITY	MFG	0	0	0	0	0	0	0
MONTAGUE	TRINITY	PWR	0	0	0	0	0	0	0
MONTAGUE	TRINITY	MIN	18	14	14	14	14	14	14
MONTAGUE	TRINITY	IRR	48	238	238	238	238	238	238
MONTAGUE	TRINITY	STK	645	796	796	796	796	796	796
WICHITA	RED	MFG	2,292	2,315	2,441	2,558	2,702	2,814	2,814
WICHITA	RED	PWR	262	360	360	360	360	360	360
WICHITA	RED	MIN	29	86	78	70	46	39	39
WICHITA	RED	IRR	19,556	59,000	58,000	57,000	56,000	55,000	55,000
WICHITA	RED	STK	740	740	740	740	740	740	740
WILBARGER	RED	MFG	841	849	904	971	1,087	1,206	1,206
WILBARGER	RED	PWR	8,700	12,000	16,000	20,000	20,000	20,000	20,000
WILBARGER	RED	MIN	28	23	24	24	24	24	24
WILBARGER	RED	IRR	28,527	18,499	17,944	17,406	16,884	16,377	16,377
WILBARGER	RED	STK	1,066	1,797	1,797	1,797	1,797	1,797	1,797
YOUNG	BRAZOS	MFG	0	0	0	0	0	0	0
YOUNG	BRAZOS	PWR	0	0	0	0	0	0	0
YOUNG	BRAZOS	MIN	0	0	0	0	0	0	0
YOUNG	BRAZOS	IRR	0	10	10	10	10	10	10
YOUNG	BRAZOS	STK	0	300	300	300	300	300	300
YOUNG	TRINITY	MFG	0	0	0	0	0	0	0
YOUNG	TRINITY	PWR	0	0	0	0	0	0	0
YOUNG	TRINITY	MIN	0	0	0	0	0	0	0
YOUNG	TRINITY	IRR	0	5	5	5	5	5	5
YOUNG	TRINITY	STK	0	20	20	20	20	20	20

CHAPTER 3

EVALUATION OF CURRENT WATER SUPPLIES

TEXAS STATE WATER PLAN

REGION B

SEPTEMBER 2010

CHAPTER 3
EVALUATION OF CURRENT WATER SUPPLIES
TEXAS STATE WATER PLAN
REGION B

Under Regional Water planning guidelines, each region is to identify currently available water supplies to the region by 1) source and 2) user. The supplies available by source are based on the water available during drought of record conditions. For surface water reservoirs, this is the equivalent of firm yield supply or permitted amount (whichever is lower). For diversions directly from a stream or river (run-of-the-river), this is the minimum supply available in a year over the historical record. Groundwater supplies are defined by availability by county and aquifer. Generally, groundwater supply is the supply available with acceptable long-term impacts to water levels. These impacts may vary with users and locations.

In addition to surface water and groundwater supplies, there are available supplies from reuse and local supplies. The available supply from reuse is based on permitted authorizations and facilities. Current reuse in Region B is negligible and limited to municipal irrigation. Local supplies generally include stock ponds for livestock.

3.1 Existing Surface Water Supply

Water users in the Region B planning area receive surface water from sources in the Brazos, Trinity and Red River Basins. In accordance with the Texas Water Development Board's (TWDB) established procedures, the surface water supplies for the regional water plans are determined using the TCEQ-approved Water Availability Models (TCEQ, 2009). Water Availability Models have been completed for each of the major river basins in Texas. The Water Availability Models were developed for the purpose of reviewing and granting new surface water rights permits. The assumptions in the Water Availability Models are based on the legal interpretation of water rights and in some cases do not accurately reflect current operations. For planning purposes, adjustments were made to the Water Availability Models to better reflect current and future surface water conditions in the region.

Generally, changes to the Water Availability Models included:

- Assessment of reservoir sedimentation rates and calculation of area-capacity conditions for current (2000) and future (2060) conditions. (See Section 3.1.2)
- Inclusion of system operation of the Lake Kemp/ Lake Diversion system
- Other corrections

Table 3.1 summarizes the currently available surface water supplies by reservoir source in Region B in acre-feet per year. Run of the river supplies and local surface water supplies are presented in Table 3.2. The Water Availability Models were also used to determine the run of the river supplies. Local supplies shown in Table 3.2 are the historical surface water use for livestock or mining reported by the TWDB. It is assumed that these estimates represent available surface water from stock ponds, which are not required to have a water right and are not included in the WAMs. Brief descriptions of reservoirs in the region are included in Section 3.1.1. Water rights associated with run of the river supplies are discussed in Section 3.1.5.

Special water resources are designated by the TWDB and include surface water resources that are located in one region and used in whole or in part in another region. Millers Creek Lake is partially located in Region B, but used in whole in the Brazos G Region. Greenbelt Lake is located in the Panhandle Planning Area (Region A) and is used in both Regions A and B. Only Greenbelt Lake is designated as a special resource by the TWDB. Descriptions of both Millers Creek Lake and Greenbelt Lake are included in Section 3.1.1.

Table 3.1
Firm Yields of Reservoirs used in Region B
-Values are in Acre-Feet per Year-

	Basin	2000	2010	2020	2030	2040	2050	2060
WATER SUPPLY SYSTEMS								
Lake Kemp/ Diversion System	Red	105,500	100,983	96,466	91,949	87,432	82,915	78,400
Wichita System								
Kickapoo	Red	20,200	19,800	19,400	19,000	18,600	18,200	17,800
Arrowhead	Red	26,000	26,000	26,000	26,000	26,000	26,000	26,000
TOTAL	*Red*	*46,200*	*45,800*	*45,400*	*45,000*	*44,600*	*44,200*	*43,800*
Subtotal		**151,700**	**146,783**	**141,866**	**136,949**	**132,032**	**127,115**	**122,200**
RESERVOIRS IN REGION B								
Lake Amon Carter	Trinity	2,200	2,107	2,014	1,921	1,828	1,735	1,640
Lake Electra	Red	470	462	454	446	438	430	420
North Fork Buffalo Creek Reservoir	Red	840	840	840	840	840	840	840
Santa Rosa Lake	Red	3,075	3,075	3,075	3,075	3,075	3,075	3,075
Lake Pauline	Red	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Lake Cooper/Olney	Red	960	960	960	960	960	960	960
Lake Nocona	Red	1,260	1,260	1,260	1,260	1,260	1,260	1,260
Subtotal		**10,005**	**9,904**	**9,803**	**9,702**	**9,601**	**9,500**	**9,395**
RESERVOIRS OUTSIDE REGION B								
Greenbelt Lake	Red	8,430	8,297	8,164	8,031	7,898	7,765	7,630
TOTAL		**170,135**	**164,984**	**159,833**	**154,682**	**149,531**	**144,380**	**139,225**

Firm yields were determined from the TCEQ-approved WAMs, as modified for regional water planning.

Table 3-2
Summary of Local Surface Water Supplies for Region B
-Values are in Acre-Feet per Year-

	Use	County	Basin	2000	2010	2020	2030	2040	2050	2060
LOCAL RUN-OF-THE-RIVER SUPPLIES										
Run-of-the-River	Irrigation	Archer	Red	7	7	7	7	7	7	7
Run-of-the-River	Irrigation	Baylor	Red	0	0	0	0	0	0	0
Run-of-the-River	Irrigation	Baylor	Brazos	17	17	17	17	17	17	17
Run-of-the-River	Irrigation	Clay	Red	2,429	2,429	2,429	2,429	2,429	2,429	2,429
Run-of-the-River	Irrigation	Cottle	Red	13	13	13	13	13	13	13
Run-of-the-River	Irrigation	Hardeman	Red	148	148	148	148	148	148	148
Run-of-the-River	Irrigation	Montague	Red	108	108	108	108	108	108	108
Run-of-the-River	Irrigation	Wichita	Red	351	351	351	351	351	351	351
Run-of-the-River WCWID #2	Irrigation	Wichita	Red	8,850	8,850	8,850	8,850	8,850	8,850	8,850
Run-of-the-River	Irrigation	Wilbarger	Red	825	825	825	825	825	825	825
Run-of-the-River - Archer City Lake	Municipal -	Archer	Red	278	278	278	278	278	278	278
Run-of-the-River - Petrolia	Municipal -	Clay	Red	107	107	107	107	107	107	107
Run-of-the-River – Henrietta	Municipal	Clay	Red	1,450	1,450	1,450	1,450	1,450	1,450	1,450
Run-of-the-River - Iowa Park/Gordon	Municipal -	Wichita	Red	555	555	555	555	555	555	555
Run-of-the-River	Municipal	Wilbarger	Red	115	115	115	115	115	115	115
Run-of-the-River	Industrial	Clay	Red	127	127	127	127	127	127	127
Run-of-the-River	Mining	Clay	Red	1	1	1	1	1	1	1
Run-of-the-River	Mining	Wilbarger	Red	30	30	30	30	30	30	30
Subtotal				**15,409**	**15,409**	**15,409**	**15,409**	**15,409**	**15,409**	**15,409**

Run-of-the River supplies were determined using the TCEQ-approved WAMs, as modified for regional water planning.

Table 3-2 (continued)

	Use	County	Basin	2000	2010	2020	2030	2040	2050	2060
Local Supply	Livestock[1]	Archer	Red	1948	2,049	2,049	2,049	2,049	2,049	2,049
Local Supply	Livestock	Archer	Brazos	116	122	122	122	122	122	122
Local Supply	Livestock	Archer	Trinity	256	268	268	268	268	268	268
Local Supply	Livestock	Baylor	Red	566	566	566	566	566	566	566
Local Supply	Livestock	Baylor	Brazos	333	333	333	333	333	333	333
Local Supply	Livestock	Clay	Red	1567	1,784	1,784	1,784	1,784	1,784	1,784
Local Supply	Livestock	Clay	Trinity	175	198	198	198	198	198	198
Local Supply	Livestock	Cottle	Red	449	449	449	449	449	449	449
Local Supply	Livestock	Foard	Red	251	251	251	251	251	251	251
Local Supply	Livestock	Hardeman	Red	288	288	288	288	288	288	288
Local Supply	Livestock	King	Red	219	437	437	437	437	437	437
Local Supply	Livestock	King	Brazos	129	257	257	257	257	257	257
Local Supply	Livestock	Montague	Red	770	949	949	949	949	949	949
Local Supply	Livestock	Montague	Trinity	581	716	716	716	716	716	716
Local Supply	Livestock	Wichita	Red	404	704	704	704	704	704	704
Local Supply	Livestock	Wilbarger	Red	959	1,617	1,617	1,617	1,617	1,617	1,617
Local Supply	Livestock	Young	Brazos	0	301	301	301	301	301	301
Local Supply	Livestock	Young	Trinity	0	20	20	20	20	20	20
Local Supply	Mining	Hardeman	Red	7	7	7	7	7	7	7
Subtotal				**9,018**	**11,316**	**11,316**	**11,316**	**11,316**	**11,316**	**11,316**

[1] TWDB historical livestock surface water use. Year 2000 supplies are the reported usage in year 2000 by the TWDB.

3.1.1 Existing Water Supply Reservoirs

Greenbelt Lake

Greenbelt Lake is located in the Panhandle Planning Area (Region A), and water from the lake is used to supply several cities in Region B. The lake is owned and operated by the Greenbelt Municipal and Industrial Water Authority, and is located on the Salt Fork of the Red River in Donley County near the City of Clarendon. Construction of Greenbelt Lake was completed in 1968, and the lake had an initial conservation capacity of 60,400 acre-feet. Greenbelt Municipal and Industrial Water Authority has a diversion right of 12,000 acre-feet per year from the lake to provide municipal, industrial, mining and irrigation water supply. The firm yield of the reservoir in year 2000 is estimated to be 8,985 acre-feet per year.

Lake Pauline

Lake Pauline is located on the upper reaches of Wanderers Creek near Quanah in Hardeman County. The dam was completed in 1928 and the reservoir had a reported conservation capacity of 4,137 acre-feet in 1968 (Bisset, 1999). Lake Pauline was formerly used as cooling water for a steam electric power plant. This facility is now privately owned and is used for recreation. The lake is permitted for 3,616 acre-feet per year of consumptive use, which includes 3,000 acre-feet per year of diversions from Groesbeck Creek. The estimated firm yield for Lake Pauline with diversions from Groesbeck Creek is 1,200 acre-feet per year.

Lakes Kemp and Diversion

Lake Kemp is located on the Wichita River, immediately upstream of State Highway 183 in Baylor County. The lake is authorized to store 318,000 acre-feet of water. Lake Diversion was constructed approximately 20 miles downstream of Lake Kemp for secondary storage with an authorized capacity of 45,000 acre-feet. The reservoir lies in both Archer and Baylor Counties.

Lake Diversion is operated in conjunction with Lake Kemp to provide water supply for municipal, industrial, irrigation, mining and recreational purposes. The City of Wichita Falls and Wichita County Improvement District No. 2 own the water rights in Lake Kemp and Lake

Diversion. Water released from Lake Kemp travels to Lake Diversion for distribution. Irrigation water is diverted into canal systems that distribute water to customers in Archer, Clay and Wichita Counties. Municipal water is diverted from the canal system to a pipe for transmission to Wichita Falls.

Due to high salinity loads in the tributaries that flow to Lake Kemp, most of the water use from Lake Kemp historically has been limited to irrigation and industrial purposes. The City of Wichita Falls has recently completed a reverse osmosis water treatment plant and infrastructure to utilize water from Lake Kemp for municipal purposes.

To improve the water quality of the Wichita River, the Red River Authority sponsors a chloride control project that diverts saline water from the South Wichita River above Lake Kemp to Truscott Brine Reservoir in Knox County. Evaluations of the effectiveness of the project found these diversions reduce the total chloride load to Lake Kemp by approximately 25 percent. This results in a lower chloride concentration in the reservoir. However, there still is a significant chloride load to the reservoir system from the North and Middle Wichita Rivers. Future proposed low flow diversions from these tributaries should further reduce the chloride loading into Lake Kemp.

The yield of Lake Kemp and Lake Diversion was evaluated as a system with releases made to Lake Diversion with target minimum elevations in Lake Diversion of 1050.0 feet msl in March and 1046.0 feet msl the remainder of the year. The elevation of 1050 feet msl is to allow the Dundee Fish Hatchery to divert water during the spring spawning season. The 1046 feet target is based in the intake constraints for American Electric Power. The total permitted diversion for the system is 193,000 acre-feet per year. The water right allows the District to divert a portion of the irrigation right (16,660 acre-feet per year) directly from the Wichita River for irrigation purposes. This portion of the water right was evaluated as a run of the river supply. Under these assumptions, the projected firm yield of the Lake Kemp/ Lake Diversion System in 2000 is 105,500 acre-feet per year.

Santa Rosa Lake

Santa Rosa Lake is located in Wilbarger County on Beaver Creek. It was constructed in 1929 by the Waggoner Estate for irrigation and had an original capacity of 15,755 acre-feet. Current use is for livestock and irrigation. It is permitted for 3,075 acre-feet per year, but recent historical use is much lower. According to a representative of the Waggoner Estate, the lake went totally dry in 1971. Recent reported use from the lake is approximately 100 to 300 acre-feet per year. The Red River Basin Water Availability Model shows a firm yield of in excess of its permitted diversion. However, in light of historical performance, Santa Rosa Lake has little reliable supply, and is not considered a major water supply source for planning purposes.

Lake Electra

Lake Electra is located on Camp Creek near the City of Electra in Wichita County. It is owned and operated by the City of Electra and has a diversion right of 600 acre-feet per year for municipal use. At normal pool elevation (1,111 feet MSL), the storage capacity of Lake Electra is 5,626 acre-feet. However, due to the relatively small drainage area (14.5 square miles), the lake is usually below its normal pool elevation. Previous reports indicate the lake may never have completely filled since construction was completed in 1950. The WAM shows the firm yield of Lake Electra is 470 acre-feet per year.

Over the past eight years Lake Electra has experienced continued low lake levels and may be in a new critical drought. To supplement Lake Electra, the City has a permit to divert up to 800 acre-feet per year from Beaver Creek for emergency municipal use. This right has been used on occasion, but there is no permanent diversion structure or transmission line. A review of available flows in Beaver Creek indicates that during some years there is very little flow during the hot dry months. In 1984, the total flow during the dry spring and summer months was less than 800 acre-feet. Also, Beaver Creek has a higher salinity level than Lake Electra. Large diversions from Beaver Creek may require additional treatment, which is currently undesirable. During a drought, diversions from Beaver Creek will be minimal because of the water quality and low flow conditions. To fully utilize this emergency right, diversions from Beaver Creek must be planned over the year.

Due to the unreliability of the City's surface water sources, the City of Electra has contracted for water from Wichita Falls through the City of Iowa Park. This supply is currently in place, and the city is not using water from Lake Electra for municipal supply.

North Fork Buffalo Creek Reservoir

The North Fork Buffalo Creek Reservoir was constructed in 1964 to provide additional water for the City of Iowa Park. The dam is located below the confluence of North Fork Buffalo Creek and Lost Creek in Wichita County. The reservoir had an original storage capacity of 15,400 acre-feet with a drainage area of 33 square miles. The current permitted water right for the reservoir is 840 acre-feet per year. North Fork Buffalo Creek Reservoir is owned and operated by the City of Iowa Park.

North Fork Buffalo Creek Reservoir is currently in drought of record conditions. During 2004, the content in the reservoir dropped to less than 400 acre-feet, which is approximately 2 percent of its conservation storage. The City stopped using water from North Fork Buffalo Creek and is purchasing water from the City of Wichita Falls. Previous studies as well as the Red River WAM report firm yield estimates greater than its permitted amount. Based on the current performance of the lake, the firm yield is most likely much less. As part of the 2006 regional water plan, additional studies of the yield of North Fork Buffalo Creek Reservoir were conducted under current and assumed future conditions. (Reference 2006 Plan) This study found that if the drought extended through 2007 and the reservoir refills, the reliable firm supply from North Fork Buffalo Creek Reservoir is approximately 750 acre-feet per year. If the drought were to extend beyond 2007, the yield would be less. An update of the yield using data through 2007 shows that the firm yield is slightly greater than the permitted amount. However, the reliable supply from North Fork Buffalo Creek Reservoir cannot be determined accurately until the drought is over and the reservoir has refilled. For this plan, it is assumed that the firm supply available from North Fork Buffalo Creek Reservoir is the permitted amount of 840 acre-feet per year.

Wichita System

The Wichita System consists of Lake Kickapoo and Lake Arrowhead. These lakes are owned and operated by the City of Wichita Falls for municipal and industrial supply. Water from the lakes is transported to Wichita Falls' water treatment plants for treatment and distribution. Some raw water is sold directly to wholesale customers. The firm yield of the Wichita System in 2000 is estimated at 46,200 acre-feet per year. A brief description of each lake follows:

Lake Kickapoo

Lake Kickapoo was built by the City of Wichita Falls in 1946 for municipal water supply with an initial conservation storage capacity of 106,000 acre-feet. The reservoir is located on the North Fork of the Little Wichita River in Archer County. It is owned and operated by the City of Wichita Falls. The diversion rights from the lake total 40,000 acre-feet per year.

Lake Arrowhead

Lake Arrowhead was built in 1966 by the City of Wichita Falls for municipal, industrial and recreational use. The lake is located on Little Wichita River in Clay County, about 12 miles southeast of Wichita Falls. The lake is owned and operated by the City of Wichita Falls. The diversion rights from Lake Arrowhead total 45,000 acre-feet per year; however, the maximum diversion from both Lake Arrowhead and Kickapoo cannot exceed 65,000 acre-feet per year. This water right condition was considered in the evaluation of the system yield.

Lakes Olney and Cooper

Lakes Olney and Cooper are a twin-lake system located on Mesquite Creek in Archer County. Lake Olney dam was constructed in 1935 to provide municipal water for the City of Olney. In 1953 the dam for Lake Cooper was built for additional storage. Collectively, the lakes have a conservation storage capacity of 6,650 acre-feet, with diversion rights of 1,260 acre-feet per year. The firm yield of these lakes is estimated at 961 acre-feet per year.

Lake Nocona

Lake Nocona is a 25,400 acre-foot reservoir located on Farmers Creek in Montague County, approximately 8 miles northeast of the City of Nocona. Construction was completed in 1960 to provide municipal water supply to the City of Nocona. The lake is owned and operated by the North Montague County Water Supply District. The original permit for Lake Nocona allowed the diversion and use of 4,500 acre-feet per year for municipal, industrial, and mining purposes.

In 1984, the final determination of water rights for the Middle Red River segment of the Red River Basin reduced the authorized diversion to 645 acre-feet per year for municipal use only. Subsequent studies reported the firm yield of the reservoir to be 1,260 acre-feet per year through year 2030 (F&N, 1986). The water right permit for diversions from Lake Nocona was amended in 1987 to 1,260 acre-feet per year for municipal, irrigation and recreational uses. The reported firm yield for Lake Nocona using the Red River WAM greatly exceeded the permitted amount. For this plan, the firm supply from Lake Nocona is 1,260 acre-feet per year.

Amon G. Carter

Lake Amon G. Carter is located on Big Sandy Creek in Montague County, about 6 miles south of the City of Bowie, Texas. The lake was originally constructed in 1956 and enlarged in 1979. It has a current storage capacity of approximately 27,500 acre-feet and an estimated firm yield of 2,200 acre-feet per year. The lake is owned and operated by the City of Bowie for water supply. The existing water right permit allows for a diversion of 5,000 acre-feet per year for municipal, industrial and mining water use.

Miller's Creek Reservoir

Miller's Creek Reservoir is located about 7 miles southeast of Bomarton, Texas in the Brazos River Basin. The dam was constructed in 1977 on Miller's Creek in Baylor County, and the reservoir extends southwest into Throckmorton County. It is owned and operated by the North Central Texas MWA. It has a permitted diversion of 5,000 acre-feet per year for municipal, industrial and mining uses. Water from this reservoir is currently used exclusively in the Brazos G Region. The yield for Miller's Creek Reservoir was determined by the Brazos G Region. Under safe yield analysis, the Brazos G reports a reliable supply of 50 acre-feet per year in 2010, reducing to no reliable supply by 2060.

Other Lakes and Reservoirs in the Region

Lake Wichita

Lake Wichita is located south of the City of Wichita Falls and lies in Archer and Wichita Counties. It was constructed in 1901 on Holliday Creek for irrigation and municipal use, but little water has been used for municipal purposes since Lake Kickapoo water supply became available. Presently, Lake Wichita is used for recreational purposes only.

Lake Iowa Park

Lake Iowa Park is located on Stevens Creek, northwest of the City of Iowa Park, and has been a source of water for the City of Iowa Park since 1949. The lake has a storage capacity of 2,565 acre-feet and the water right permit allows a diversion of 500 acre-feet per year for municipal use. The lake has recently experienced severe drought conditions and was nearly dry in years 2000 and 2004. The City of Iowa Park is no longer using this lake for water supply.

3.1.2 Sedimentation and Impacts to Reservoir Yields

Sediment production rates in Region B vary considerably due to land use, soil types and topography. Wind erosion is quite active across the rolling prairies and cultivated fields. The USGS and U.S. Soil Conservation Services have compiled much of the sedimentation data available for reservoirs in Region B. Lakes Kickapoo, Arrowhead, Kemp and Nocona have recently published volumetric surveys, which were used to estimate sedimentation rates. Estimates of sedimentation rates for the other lakes were developed from several sources. For sedimentation rates developed from the Texas Board of Water Engineers Report 5912, the effects of SCS structures and development were considered. Estimates of reservoir capacities for years 2000 and 2060, based on the reservoir's drainage area and sedimentation rate, are presented in Table 3-3. Since the yield of a reservoir is affected by the reservoir's area-capacity relationship, high sedimentation rates will reduce the reservoir's storage capacity and firm yield. The projected reservoir yields over the planning period are shown in Table 3-1.

As shown on Table 3-3, there are areas with highly erodible soils in Region B that contribute to the accumulation of sediment, which can significantly impact reservoir storage capacities. Reservoirs with higher sedimentation rates include Lakes Kickapoo, Nocona and Arrowhead. The recent volumetric survey for Lake Kemp shows lower sediment accumulation than previously predicted. This has resulted in greater projected storage over the planning period.

Table 3-3: Estimated Sedimentation Rates and Projected Capacities

Reservoir	Drainage Area (Sq mi)	Sediment Rate (af/yr/sq mi)	Year of Initial Capacity	Capacities (Ac-ft)			Source (sediment rate)
				Initial	2000	2060	
Lake Pauline	42.6	0.68	1971	4,137	3,297	1,559	TBWE 1959
Lake Kemp	2086	0.90	1922[1]	(1)	245,434	207,617	TWDB, 2006
Santa Rosa Lake	334	0.14	1929	15,755	8,245	5,434	Espey,2002
Lake Electra	14.5	0.69	1998[2]	5,626	5,606	5,006	TBWE 1959
North Fork Buffalo Creek	33	0.86	1964	15,400	14,378	12,676	TBWE 1959
Lake Kickapoo	275	1.325	1946	106,400	85,825	64,417	TWDB, 2001
Lake Arrowhead	832	0.98	1966	262,100	235,997	188,278	TWDB 2001
Olney/Cooper	12.3	0.68	1935/1953	6,650	6,165	5,663	TBWE 1959
Lake Nocona	94	1.14	1961	25,400	21,749	15,478	TWDB, 2002
Amon Carter	101	0.51	1980[3]	28,589	27,826	24,772	HDR, 1981

1. The capacity of Lake Kemp in 1922 was estimated 560,000 ac-ft at elevation 1153ft. There are multiple datum references used over time for estimates of reservoir volume. In 1973 the USACE estimated the volume of the lake at 268,000 ac-ft at the current conservation elevation of 1144 ft msl. The sediment rate shown considers the full record of data.
2. 1998 area-capacity data. Previous survey conducted in 1987 indicated much larger capacity.
3. Enlargement of the Lake Amon Carter was completed in 1980 and area-capacity was determined at that time

3.1.3 Reservoir Water Rights

Water rights for reservoirs located in Region B are summarized on Table 3-4. Comparisons of rights to firm yields indicate that water rights for several of the reservoirs in Region B exceed firm yield. The current yield of Lake Kemp is about 55 percent of the total permitted diversion. The firm yields for Lakes Amon Carter and Greenbelt are about half of the permitted diversions.

A summary of the existing known contracts by reservoir is presented on Table 3-5. With the exception of the City of Wichita Falls, the primary water right holders are not included on Table 3-5.

Table 3-4:

Summary of Reservoir Water Rights

Reservoir	Water Right No.	Priority Date	Holder	Water Right Amount (acre-feet/year)						2000 Yield[2] (ac-ft/yr)
				Mun	Ind	Irr	Mining	Rec	Total	
Greenbelt	5233	8/11/58	Greenbelt MIWA	14,530	500	250	750		16,030	8,430
Pauline/ Groesbeck	5230	6/27/14 3/5/45	American Electric Power		3,600	16		0	3,616	1,200
Kemp/ Diversion	5123	10/2/20	Wichita Co WID#2 Wichita Falls	25,150	40,000	120,000[1]	2,000	5,850	193,000[1]	105,500
Santa Rosa	5124	6/30/26	W.T. Waggoner Estate			3,075			3,075	3,075
Electra	5128 5128	3/29/49 2/25/74	City of Electra Emergency supply	600 800					600 800	470 0
Kickapoo	5144	6/21/44	Wichita Falls	40,000					40,000	
Arrowhead	5150	6/20/62	Wichita Falls	45,000					45,000	46,200
Olney/ Cooper	5146	3/26/53	City of Olney	1,260					1,260	960
N.F. Buffalo Creek	5131	9/19/62	City of Iowa Park	840					840	840
Iowa Park/ Lake Gordon	5132 5133	8/3/49 11/22/38	City of Iowa Park	500 300					800	500
Nocona	4879	10/9/58	North Montague Co. WSD	1,080		100		80	1,260	1,260
Amon Carter	3320	7/12/54	City of Bowie	3,500	1,300		200		5,000	2,200

Mun – Municipal Use   Ind – Industrial Use   Irr – Irrigation Use   Rec – Recreational Use

1. Water rights have been sold. New owner is not reported in TCEQ dated base. (2009)
2. Water right 5123 includes the ability to divert 16,660 acre-feet per year of the permitted 120,000 acre-feet per year directly from the river for irrigation. This portion of the right was evaluated as a run-of-the-river right and is also shown in Table 3-2.
3. Yield reported is the firm yield as determined for this plan.

Source: Texas Commission on Environmental Quality, Water Rights Database, 2009.

Table 3-5:

Summary of Existing Water Supply Contracts in Region B

Source Name	Contract Holder	Contract Amount		Comment
		MGD	AF/YR	
Greenbelt	Crowell		250	No Contract Amount – 2006 Historical Use
Greenbelt	Quanah		496	No Contract Amount – 2006 Historical Use
Greenbelt	Red River Authority		260	No Contract Amount – 2000 Historical Use
Kemp/Diversion	American Electric Power		20,000	Contract
Kemp/Diversion	TPW Dundee Fish Hatchery		2,200	
Nocona	Nocona Hills Owners Assoc		246	Contract
Wichita System	Archer City	0.6		Contract – Lake Kickapoo
Wichita System	Archer County MUD #1	0.15		Contract, No Expiration Date
Wichita System	Burkburnett	3.3		Contract
Wichita System	Dean Dale WSC	0.825		Contract, No Expiration Date
Wichita System	Friberg-Cooper WSC	0.25		
Wichita System	Henrietta			Wichita Falls must meet Henrietta's senior water right
Wichita System	Holliday		226	No Contract Amount – 2006 Demands
Wichita System	Iowa Park	5.2		1.5 MGD provided to Electra
Wichita System	Lakeside City	0.35		
Wichita System	Olney	1		Contract – Lake Kickapoo
Wichita System	Pleasant Valley		121	No Contract Amount – 2000 Demands
Wichita System	Red River Authority	0.75		
Wichita System	Scotland	0.25		
Wichita System	Sheppard AFB			Part of Wichita Falls Demands
Wichita System	Wichita Falls		18,408	2006 Historical Use
Wichita System	Wichita Valley WSC	1.85		
Wichita System	Windthorst WSC	0.75		

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3.1.4 Run-of-the-River Supplies

Portions of three river basins are located in Region B. The Red River and its tributaries represent the largest river system, flowing across the central and northern areas of the region. The Brazos River flows through the southern portion of King and Baylor Counties, and the upper tributaries of the Trinity River lie in southwest Montague County.

The Red River forms the northern boundary of Region B and flows eastward along the Texas – Oklahoma border. Major tributaries within the region include the Pease River, Wichita River and Little Wichita River. High concentrations of total dissolved solids, sulfate and chloride are concerns for the upper reaches of these streams during low flow conditions. Naturally occurring salt springs, seeps and gypsum outcrops are found in the area westward of Wichita County to the High Plains Caprock Escarpment in the Panhandle Region Planning Area. As a result water from these rivers in Cottle, Foard, King, Hardeman and parts of Baylor and Wilbarger Counties is generally not used or is restricted to irrigation use only. The quality of the water gradually improves downstream toward the eastern portion of the region.

Existing run-of-the river water rights for the Red River system in Region B are shown on Table 3-6 and include major rights on the Red River in Clay County, Little Wichita River, Wichita River and Beaver Creek. Beaver Creek is a tributary to the Wichita River, and flows eastward from Foard County to the Wichita River in Wichita County. Groesbeck Creek, which has a large water right associated with Lake Pauline, is addressed with this reservoir. Generally, rights associated with reservoirs and unnamed tributaries or smaller rivers and streams that have no reliable water supply are not included on Table 3-6.

The total available supplies from the run-of-the-river diversions are shown on Table 3-2. These supplies were determined using the Water Availability Models and represent the minimum diversion in a year over the historical record in the respective model.

Table 3-6:
Run of the River Water Rights

Water Right	County	Permitted Amount (af/yr)	Use	Owner
Red River				
5143	Clay	200	Irrigation	Joe J. Parker
Little Wichita River				
4268	Clay	3,600	Irrigation	A.L. Rhodes
5147	Archer	30	Irrigation	Joy Graham
5152	Clay	1,560	Municipal	City of Henrietta
5153	Clay	50	Irrigation	Clay County Country Club Inc.
5154	Clay	15	Irrigation	Johnnie H. Shaw
Wichita River				
4433	Wichita	300	Irrigation	Alvin & Nana Robertson
5123	Wichita	16,660	Irrigation	WCWID #2
5135	Clay	357	Irrigation	Eagle Farms, Inc.
5136	Clay	200	Irrigation	Joe L. Hale Estate
5138	Clay	55	Irrigation	M.E. McBride
5139	Clay	30	Irrigation	Bob Brown
5140	Clay	270	Industrial	Red River Feed Yard, Inc.
5530	Wichita	32	Irrigation	Joe L. Burton
Beaver Creek				
5125	Wilbarger	675	Irrigation	W.T. Waggoner Estate
5126	Wilbarger	60	Municipal	W.T. Waggoner Estate
5127	Wilbarger	85	Municipal, Mining	W.T. Waggoner Estate
5129	Wichita	404	Irrigation	Harry L. Mitchell
5393	Wichita	450	Irrigation	James Brockriede
5128[1]	Wilbarger	800	Municipal	City of Electra
Groesbeck Creek				
5225	Hardeman	96	Irrigation	Hunter Brothers
5226	Hardeman	60	Irrigation	FW Howard Jr.
5227	Hardeman	100	Irrigation	FW Howard Jr. & Wife
5228	Hardeman	63	Irrigation	BJ Howard & Wife
5231	Hardeman	41	Irrigation	Garland Welborn
Antelope Creek				
5130	Wichita	40	Irrigation	Hulen J. Cook Jr. Et Al
Big Mineral Creek				
5113	Wilbarger	150	Irrigation	James David Belew & Wife
Sherwood				
5238	Wilbarger	160	Irrigation	Joyce Virginia Chapman

Table 3.6 (Continued)

Water Right	County	Permitted Amount (af/yr)	Use	Owner
Devils Creek				
5112	Hardeman	45	Irrigation	Texas Parks & Wildlife Dept.
Armand Bayou				
5230	Hardeman	16	Irrigation	AEP Texas North Company
Belknap				
4874	Clay	30	Irrigation	Herschel H. Studdard
4875	Montague	133	Irrigation	Clarice Benton Whiteside
Frog Creek				
5142	Clay	200	Irrigation	Joe J. Parker
Long Creek				
5109	Clay	200	Irrigation	A D Hanna
Mesquite Creek				
5146	Archer	35	Irrigation	City of Olney
Deep Draw				
5605	Montague	100	Irrigation	Jerry D. Nunneley
Pease Creek				
5111	Cottle	23	Irrigation	John E. Isbell Jr. & Wife

1. This water right is associated with Lake Electra. It is a right to divert water from Beaver Creek to Lake Electra for emergency municipal use.

Source: Texas Commission on Environmental Quality, Water Rights Database, 2009.

3.2 Groundwater Supplies

3.2.1 General Description

Groundwater is primarily supplied in Region B by two aquifers, the Seymour and the Blaine. The Seymour is designated a major aquifer and is found in the central and western portions of the region. It is currently used in Hardeman, Wilbarger, Wichita, Clay, Baylor and Foard Counties. The Blaine is considered a minor aquifer and useable groundwater is limited to the westernmost portion of the region. These aquifers provide a large percentage of available supply in these counties. In addition, the upper portion of the Trinity Aquifer occurs in Montague County in the eastern part of the region. Limited quantities of groundwater are used from the

Trinity for municipal and irrigation uses. There are also other formations within the region that are used for groundwater supply in limited areas. The TWDB identifies these sources as "Undifferentiated Other Aquifer". These formations are not well defined in the literature, but still provide substantial quantities of water in Archer, Clay, Cottle, Montague, Wilbarger and Wichita Counties. For purposes of this report, the groundwater availability for "Other Aquifers" will be determined from the reported historical use.

Seymour Aquifer

The Seymour Formation consists of isolated areas of alluvium that vary in saturated thickness from less than 10 feet to over 80 feet. This aquifer is relatively shallow and exists under water table conditions in most of its extent. Artesian conditions can occur where the water-bearing zone is overlain by clay. The upper portion of the Seymour consists of fine-grained and cemented sediments. The basal portion of the formation has greater permeability and produces greater volumes of water. Yields of wells typically range from 100 gpm to 1,300 gpm, depending on the saturated thickness, and average about 300 gpm.

Recharge to the Seymour is largely due to direct infiltration of precipitation over the outcrop area. Surface streams adjoining the outcrop are at elevations lower than the water levels in the Seymour Aquifer and do not contribute to recharge. Other possible sources of recharge include infiltration from irrigation or upward leakage of water from underlying Permian formations, but these amounts are insignificant.

Natural discharge from the Seymour occurs through seeps and springs, evapotranspiration, and leakage to the underlying Permian formations. It is estimated that a large part of the Seymour's total natural discharge is from evapotranspiration from plants and is considerably larger than discharges to seeps and springs (TWDB Report 337, 1992).

Water quality of the Seymour is variable throughout the region, and generally ranges from fresh to slightly saline. Brine pollution from earlier oil activities and excessive pumping has caused localized concentrations of minerals in the alluvium, limiting the full utilization of the water resource. In addition, high nitrate concentrations occur in the groundwater over a wide area.

These nitrate concentrations are often due to agricultural practices, and can be attributed to nitrogen fertilizer or leaching from areas formerly covered by nitrogen fixing vegetation such as grasses or mesquite groves. Other sources of nitrate include organic matter from poorly functioning septic systems, infiltration of animal wastes or naturally occurring sources.

Blaine Aquifer

The Blaine Formation extends in a narrow outcrop band from Wheeler to King Counties. Groundwater occurs in numerous solution channels and caverns in beds of gypsum and anhydrite. In most places the aquifer exists under water table conditions, but it is also artesian where overlain by the Dog Creek Shale. Saturated thickness of the aquifer approaches 300 feet in its northern extent, and is generally less in the Region B area. Well yields vary considerably from one location to another due to the nature of solution channels. It is common for dry holes to be found adjacent to wells of moderate to high yield. The average well yield is 400 gpm.

The primary source of recharge to the Blaine Aquifer is precipitation that falls on the High Plains Escarpment to the west and the Blaine outcrop area. The solution openings and fractures in the gypsum provide access for water to percolate downward. The Blaine Aquifer may also receive some recharge from the overlying Dog Creek Shale.

Water in the Blaine Aquifer generally moves eastward through the solution channels, dissolving mineral deposits along the way, and discharging to low topographic areas. The dissolved solids concentrations in the aquifer increase with depth and generally range from 1,000 to over 10,000 mg/l. Due to the high mineral content, the TWDB has limited the extent of the Blaine Aquifer to areas with water less than 10,000 mg/l of dissolved solids.

Natural salt springs and seeps from the Blaine formation contribute to increased salinity of surface water. Due to the high mineral content the Blaine Aquifer has been used primarily for irrigation of salt tolerant crops.

Trinity Aquifer

The Trinity Group consists of three formations, the Travis Peak, Glen Rose and Paluxy. In the northern part of its extent, the Glen Rose thins out and the Travis Peak and Paluxy coalesce into a single geologic unit known as the Antlers Formation. In Region B, the Trinity Group outcrops in the eastern portion of Montague County. The thickness of the Trinity Aquifer ranges from less than 10 feet to 600 feet. Water table conditions occur in outcrop area, while artesian conditions exist in the downdip formation. Well yields in the Trinity Aquifer range from moderate to low. The effective recharge for the entire Trinity Aquifer as determined by the Texas Department of Water Resources (TDWR) is 1.5 percent of the mean annual precipitation over the outcrop area (TDWR, 1982).

Limited amounts of good quality water can be obtained from the Trinity in Montague County. Groundwater is generally used for municipal, mining, irrigation and livestock purposes. Water level declines have been recorded in heavily pumped areas to the south and southeast of Montague County.

Managed Available Groundwater

Texas is in the midst of a joint planning initiative for groundwater. One of the results of this planning effort will be the development of groundwater availability values to be used for regional water planning. The TWDB, which oversees this initiative, has divided the state into Groundwater Management Areas (GMA) based on locations of major and minor groundwater aquifers. The planning effort within each GMA is directed by the Groundwater Conservation Districts (GCDs) that fall within the GMA. Each GMA has been tasked with adopting desired future conditions of each aquifer that lies within the GMA. Based on these conditions, the TWDB will develop managed available groundwater (MAG) values that will be used by the GCDs and the regional water planning groups to effectively manage the state's groundwater resources.

Most of the counties in Region B are in GMA 6, with Montague County included in GMA 8. Since the last planning cycle, the GCDs have been meeting in their respective GMAs to discuss approaches for determining desired future conditions and MAGs. At this time, the only MAG that has been determined is in GMA 8 for the Trinity Aquifer in Montague County. The TWDB documented this MAG in GAM Run 08-84mag (TWDB, 2009). These values have been adopted as the available supply for the Trinity Aquifer in Montague County.

Springs in Region B

The most comprehensive source of information on major springs in Texas was published in 1981 (Brune, 1981). This work identified six major springs in Region B that are listed in Table 3-7. Some of these springs had historical significance as water supplies for nomadic Indians and western travelers. None of these springs are currently used for water supply, and at least one is no longer flowing.

Table 3-7
Major Springs in Region B

County	Spring	Location	Status
Baylor	Buffalo Springs	3 miles west of Seymour	Flow at 25 gpm in 1969
Clay	Buffalo Springs	At Buffalo Springs	Uncertain
Montague	Barrel Springs		No longer flowing
Wichita	China Springs	2 miles west of Haynesville	Brackish water flow at 100 gpm in 1970
Wilbarger	Doans Springs	1 mile northwest of Doans	Flowing in 1970. Impounded in a recreational lake.
	Condon Springs	3 miles northwest of Vernon	Flowing in 1969

3.2.2 Groundwater Availability and Recharge

The average annual groundwater availability is the amount of water that could be reasonably developed from the aquifer. It is comprised of the annual effective recharge plus the amount of water that can be recovered annually from storage over a specified period without causing excessive drawdown or irreversible harm, such as subsidence or water quality deterioration.

As part of Senate Bill 1 the TWDB initiated a comprehensive groundwater availability modeling program to assist groundwater conservation districts and regional water planning groups in determining available groundwater supplies. The groundwater availability models (GAM) for the Northern Trinity, Seymour and Blaine Aquifers were published in late 2004. These models use a 3-dimensional groundwater flow model (Modflow) to estimate aquifer response to stresses placed on the system (such as well pumping). A review of the results of the Seymour Groundwater Availability Model found that the available supplies from this source were generally consistent with the supplies determined for the 2006 plan. Differences include a change in the delineation of the Seymour Aquifer in Cottle County and greater recharge in Wilbarger County. The TWDB redefined the Seymour Aquifer in 2007, removing the designation of the aquifer in Cottle County. Supplies from local formations in Cottle County are now assigned to “Other Aquifer”. Also, the Seymour GAM model shows greater availability in Wilbarger County resulting from the increased recharge. For this plan update, the available supply from the Seymour Aquifer in Wilbarger was increased to 40,000 acre-feet per year. This value will be updated when the managed available groundwater values are determined by GMA 6 and the TWDB. There are no changes from the 2006 water plan for the Blaine Aquifer. The GAM for this aquifer did not include all of the Blaine formation and the current use of this aquifer is limited. The availability for the Trinity Aquifer is the managed available groundwater value determined by GMA 8 and the TWDB (TWDB, 2009).

With the exceptions noted above, the supplies from the Seymour and Blaine Aquifers were determined using previous studies. As part of the 1997 State Water Plan, the TWDB evaluated the groundwater availability for the major and minor aquifers of the state. Previous publications and water well data were used to derive annual groundwater availability. Effective recharge was determined by applying a percentage of the mean annual precipitation upon the aquifer's outcrop area. For the Seymour, the TWDB used a conservative estimate of 5 percent of the average annual precipitation for the entire Seymour formation. This percentage was generally based on the low flow analyses used in the groundwater studies of Baylor and Jones Counties (TDWR Report 238, 1979). In addition, an estimated annual amount recoverable from storage was determined based on using 75 percent of the total storage over the 57-year period from 1974 through 2030. After 2030, it was assumed no water would be available from storage, limiting availability to recharge.

Reviews of previous groundwater publications found a range of reportable recharge rates and availability estimates for the Seymour Aquifer. The Baylor study (TDWR, 1978) indicated an effective recharge rate of 10 percent of the average annual precipitation for the year 1969. However, groundwater availability was limited in some areas due to thin saturated thickness and high loss to evapotranspiration. The Baylor study also did not include mining of groundwater from storage due to the nature of the near surface aquifer (i.e., did not want to create abnormally low water levels.) More recently, a study by Woodward Clyde for the City of Vernon estimated the recharge to the Seymour in the Odell-Lockett area in Wilbarger County to be approximately 15 percent of the average rainfall (Woodward-Clyde, 1998).

This higher estimate of recharge appears to be limited to specific areas and cannot be applied over the regional aquifer. Also, it is unrealistic to expect that all aquifer recharge will be available for development. The TWDB estimate of 5 to 7 percent of the annual precipitation is a reasonable estimate of effective recharge for the Seymour, and is appropriate for regional water planning purposes. However, since the Seymour Aquifer is a near-surface unconfined aquifer and is sensitive to recharge and withdrawals, mining of the aquifer may adversely affect the water supply. Therefore, for this plan, the mining of storage is not included in the groundwater availability estimates for the Seymour.

For the Blaine Aquifer, comparisons of declines of water levels and pumpage were used to estimate effective recharge. In Hardeman County, Maderak (TDWR, 1972) determined the effective recharge to the Blaine to be between 5 and 7 percent of the average annual precipitation. The TWDB used a conservative estimate of 5 percent for water availability planning. No recoverable storage from the Blaine Aquifer was included in the availability estimates. For the Blaine, the groundwater estimates include water with total dissolved solids (TDS) up to 10,000 mg/l. For the other aquifers in the region, the availability estimates were limited to water containing less than 3,000 mg/l of dissolved solids.

The TWDB methodology for groundwater availability for the Blaine Aquifer is appropriate for this planning effort. However, the Blaine Aquifer has a large amount of groundwater with moderate to high salinity. As a result much of the water from this formation is not used in the region. Therefore, the groundwater availability from the Blaine is broken down by TDS level. Based on historical water quality data, there is little to no water available for municipal purposes. (Small amounts of water from the Blaine Aquifer are currently being used for municipal purposes in areas with limited water resources.) Water with TDS levels between 1,000 and 3,000 mg/l is appropriate for irrigation, livestock, mining and some industrial uses. Water with TDS levels greater than 3,000 mg/l may be available with treatment or irrigation of salt tolerant crops.

Groundwater availabilities for the Seymour and Blaine Aquifers were re-calculated as 5 percent of the mean annual rainfall over the outcrop area, using historical precipitation data and the delineation of recharge areas. The availability estimates for the Trinity are the MAG values provided to the regions on March 31, 2009. A summary of groundwater availability by aquifer and county is presented in Table 3-8. Table 3-9 shows the availability in the Blaine Aquifer by concentration of TDS.

Table 3-8:
Groundwater Availability – Region B

County Name	Basin	Aquifer Name	Groundwater Availability (af/yr)	Effective Recharge Rate (in/yr)
Baylor	Brazos	Seymour	8,205	1.35
Baylor	Red	Seymour	1,485	1.35
Baylor	*Total*	*Seymour*	*9,690*	*1.35*
Clay	Red	Seymour	7,870	1.39
Cottle	Red	Blaine	27,100	1.01
Foard	Red	Seymour	12,130	1.23
Foard	Red	Blaine	15,390	1.19
Hardeman	Red	Seymour	15,390	1.18
Hardeman	Red	Blaine	23,770	0.92
King	Red	Blaine	17,590	1.10
Montague	Red	Trinity	129	0.51
Montague	Trinity	Trinity	2,545	0.51
Montague	*Total*	*Trinity*	*2,674*	*0.51*
Wichita	Red	Seymour	13,920	1.38
Wilbarger	Red	Seymour	40,000	1.28

Note: 1. Groundwater availability for the Trinity Aquifer is based on MAG values provided by the TWDB. There were no adopted MAGs for the Seymour or Blaine aquifers by the deadline for this plan update.
2. Groundwater availability values are the same for all decades in the planning period.

Table 3-9:
Availability in Blaine Aquifer by TDS

County	Basin	Groundwater Availability (af/yr)			
		Total	*TDS (mg/l):*		
			1,000 - 3,000	*3,000 - 10,000*	*>10,000*
Cottle	Red	27,100	6,494	18,153	2,453
Foard	Red	15,390	10,945	4,445	0
Hardeman	Red	23,770	13,601	10,169	0
King	Red	17,590	3,706	13,884	0

As shown on the above tables, there are large quantities of water available in the Seymour and Blaine Aquifers, and limited quantities in the Trinity Aquifer. However, the water in the Blaine is unsuitable for municipal use without additional treatment, and only a portion is readily available for other uses. Water quality issues associated with the Seymour Aquifer (nitrates and TDS) also limit the usefulness of this resource. Historical use indicates that with the exception of Wilbarger County, much of the groundwater is not fully developed or not currently being used. A comparison of the 2003 historical use and groundwater availability estimates is shown on Table 3-10.

Table 3-10:
Groundwater Historical Use

County	Aquifer	Availability (af/yr)	Historical Use-2003 (af/yr)
Baylor	Seymour	9,690	2,155
Clay	Seymour	7,870	1,139
Cottle	Blaine	27,100	3,569
Foard	Seymour	12,130	3,683
Foard	Blaine	15,390	42
Hardeman	Seymour	15,390	130
Hardeman	Blaine	23,770	5,283
King	Blaine	17,590	256
Montague	Trinity	2,682	300
Wichita	Seymour	13,920	2,905
Wilbarger	Seymour	40,000	31,808

Source: TWDB, historical groundwater pumpage data, 2003.

The groundwater availability for “Other Aquifer” was based on historical use. A summary of supplies from this source are shown in Table 3-11.

Table 3-11
Supplies from Other Aquifer in Region B

County	Basin	Groundwater Availability (ac-ft/yr)
Archer	Red	1,175
Archer	Brazos	151
Archer	Trinity	175
Clay	Red	884
Clay	Trinity	142
Cottle	Red	451
King	Red	167
King	Brazos	61
Montague	Red	548
Montague	Trinity	505
Wichita	Red	658
Wilbarger	Red	11

Note: Region B also receives 86 acre-feet per year of groundwater from Dickens County in Region O.

3.2.3 Reliability of Local Supplies

Many of the local cities and communities in Region B rely on groundwater for all or a portion of their municipal supply. Those communities that use groundwater exclusively include the cities of Vernon, Seymour, Paducah, Saint Jo and Montague. The cities of Burkburnett and Chillicothe use a combination of groundwater and surface water. Also, several water supply corporations use groundwater to supply rural areas. Based on surveys of the water users in Region B, some of these users are experiencing lower water table elevations, nitrate contamination, and/or salt water intrusion of their groundwater supplies. Nitrate contamination is a particular concern in the Seymour Aquifer.

3.2.4 Groundwater Conservation Districts

There are three groundwater conservation districts located in Region B. The Rolling Plains Groundwater Conservation District covers Baylor, Knox and Haskell Counties. Only Baylor County is in Region B, which uses water from the Seymour Aquifer. The Gateway Groundwater

Conservation District covers Cottle, Foard and Hardeman Counties in the northwestern part of Region B. Both the Blaine and Seymour Aquifers are present in this District. The Upper Trinity Groundwater District includes Montague County in the eastern part of the region, which manages the Trinity Aquifer.

3.3 Inter-Basin Transfers and Inter-Region Transfers

There is only one known inter-basin transfer in Region B. This is from Lake Kickapoo in the Red River Basin to the City of Olney in the Brazos Basin. The City of Olney has a contract with the City of Wichita Falls to provide 1 MGD of water during peak demands. Most years this additional supply is not used or minimally used.

Inter-regional transfers occur from the Panhandle Planning Area to Region B through the Greenbelt Municipal and Industrial Water Authority. In addition, a small amount of groundwater from Dickens County in Region O is supplied to Guthrie in King County.

3.4 System Operations and Reliability

The analysis for current surface water supplies within the region is based on the firm yield of the reservoirs. This approach is required by the Senate Bill 1 regulations, but it is often not reflective of how reservoir yields have been determined in other planning efforts. Firm yield analyses determine the amount of water that is available on an annual basis during a repeat of historical drought of record condition assuming all the water in the reservoir is available for use. This means that the reservoir content will approach zero sometime during the drought period if the firm yield is used. This analysis is also based on the historical rainfall and runoff for each reservoir. Experts at the University of Arizona's Climate Assessment Project for the Southwest recently indicated that Texas might be heading into a significant dry period. Since 1995 climatic patterns have shifted, bringing warmer drier weather to the Southern United States. This phenomenon called the Pacific Decadal Oscillation usually lasts 20 to 30 years (San Antonio Express News, 2/7/00). If this happens, then the region may be entering a new drought period that may surpass the historical drought of record and the firm yield may overestimate the available water supply. However, it is still too early to assess the impact of this weather shift.

Based on these concerns and the uncertainties inherent with the yield analyses, the available water supply for the region may be less than shown on Table 3-1. For these reasons, most water supply systems will not allow their reservoir contents to drop to very low levels without utilizing alternative supplies and implementing drought contingency measures. Many cities within Region B have initiated drought contingency measures in the past decade in response to continuing dropping reservoir levels and are actively considering alternative water sources.

To provide a more conservative estimate of the available surface water supply within the region, safe yield analyses were conducted for the municipal reservoirs in Region B. The safe yield analysis utilizes the same historical hydrology as the firm yield analysis, but assumes that a one-year supply of water is reserved in the reservoir at all times. This analysis has been commonly used for water resource planning in this region in the past. However, the one-year reserve amount may still be less than the preferred minimum operating content. For the City of Wichita Falls, severe drought contingency measures are initiated when the content of the Wichita System drops below 40 percent (137,000 acre-feet), which is much greater than a one-year reserve. Using the Water Availability Models, the safe yields for reservoirs in Region B are shown on Table 3-12.

Table 3-12
Summary of Safe Yield Analyses
-Values are in Acre-feet per Year-

Reservoir	2000	2010	2020	2030	2040	2050	2060
Wichita System	35,800	34,884	33,968	33,052	32,136	31,220	30,300
Lake Kemp/Diversion System	65,900	62,383	58,866	55,349	51,832	48,315	44,800
North Fork Buffalo Creek [1]	700	690	680	670	660	650	640
Amon Carter	1,500	1,450	1,400	1,350	1,300	1,250	1,200
Olney/ Cooper	760	760	760	760	760	760	760
Greenbelt	7,000	6,863	6,726	6,589	6,452	6,315	6,180

1. North Fork Buffalo Creek Reservoir is in drought of record conditions. The safe yield of this reservoir may be less than shown in Table 3-12.

3.5 Allocation of Existing Supplies

3.5.1 Water User Groups

To assess the projected water shortages in the region, the currently available supplies were allocated to each water user. Surface water allocations are based on current water rights, contracts, available yields, and current infrastructure capacities, accounting for the most restraining limitation. Groundwater allocations are based on current developed well fields, considering aquifer limits and availability. Surface water use reported to TWDB for livestock watering was assumed supplied by on farm stock ponds.

The supplies to each water user are shown in the Water User Group Summary Tables in Appendix A. A summary of the currently available supplies by county is presented in Table 3-13.

Table 3-13
Summary of Currently Available Supplies by County
-Values are in Acre-feet per Year-

County	2010	2020	2030	2040	2050	2060
Archer	7,518	7,367	7,239	7,097	6,921	6,772
Baylor	4,452	4,452	4,452	4,452	4,452	4,452
Clay	8,687	8,595	8,507	8,420	8,342	8,309
Cottle	5,792	5,794	5,795	5,797	5,797	5,797
Foard	6,081	6,066	6,052	6,040	6,032	6,021
Hardeman	8,677	8,660	8,667	8,653	8,653	8,604
King	1,295	1,296	1,295	1,295	1,294	1,294
Montague	6,334	6,267	6,200	6,133	6,066	6,000
Wichita	77,695	74,475	71,240	68,002	64,805	61,543
Wilbarger	46,052	45,323	44,594	43,865	43,136	42,408
Young (P)	1,379	1,379	1,379	1,379	1,379	1,379
TOTAL	**173,962**	**169,674**	**165,420**	**161,133**	**156,876**	**152,578**

3.5.2 Wholesale Water Providers

There is one wholesale water provider in Region B: the city of Wichita Falls. The city currently receives water from three primary sources: Lake Arrowhead, Lake Kickapoo and Lake Kemp. The city has completed a reverse osmosis water treatment plant that allows the city to treat and use up to 10 mgd of water from Lake Kemp. Wichita Falls also has water rights for Lake

Wichita, but this lake is currently used only for recreational purposes. The total available supply to Wichita Falls is shown in Table 3-14.

Table 3-14
Available Supply to Wichita Falls
-Values are in Acre-feet per Year-

Safe Yield[1]	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Kickapoo	14,250	13,592	12,934	12,276	11,618	10,960	10,300
Arrowhead	21,550	21,292	21,034	20,776	20,518	20,260	20,000
Wichita System	**35,800**	**34,884**	**33,968**	**33,052**	**32,136**	**31,220**	**30,300**
Kemp Municipal[2]	0	6,097	5,753	5,410	5,066	4,722	4,379
Total – Wichita Falls	**35,800**	**40,981**	**39,721**	**38,462**	**37,202**	**35,942**	**34,679**

1. Safe yield was calculated for the Wichita System.
2. Supply from Lake Kemp is limited by the proportional safe yield for municipal use and assuming a 25 percent loss during treatment.

3.6 Summary of Currently Available Supplies

The total amount of firm supply currently available to Region B is approximately 376,000 acre-feet per year (year 2010), as shown on Table 3-15. This represents firm supply available to the region. The safe yield supply totals approximately 325,000 acre-feet per year in 2010. However, the supply that is available to each user is less due to operational and contractual constraints, infrastructure limitations and water treatment capacities. A comparison of the regional firm supply to the total currently available supply to the water users is shown on Figure 3-1.

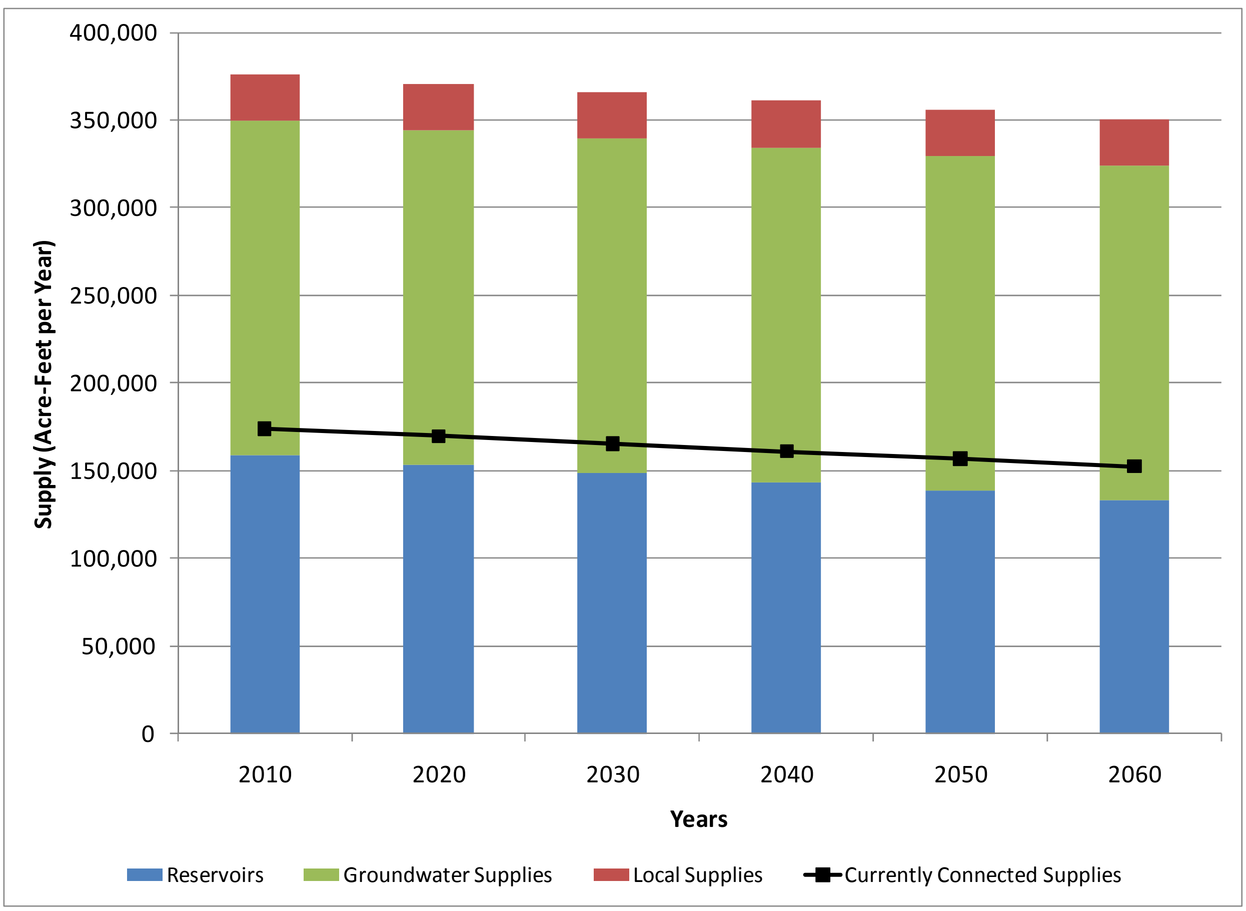
By 2060, the firm supply to Region B decreases by about 25,000 acre-feet per year. This is mostly due to the reduced storage capacities of existing reservoirs due to sediment accumulation.

Table 3-15
Summary of Firm Supplies to Region B
-Values are in Acre-feet per Year-

	2000	2010	2020	2030	2040	2050	2060
Reservoirs in Region B	161,705	156,687	151,669	146,651	141,633	136,615	131,595
Reservoirs outside Region B[1]	1,778	1,778	1,746	1,737	1,710	1,701	1,641
Run-of-the-River Supplies	15,409	15,409	15,409	15,409	15,409	15,409	15,409
Local Supplies	9,018	11,316	11,316	11,316	11,316	11,316	11,316
Groundwater Supplies	190,817	190,817	190,817	190,817	190,817	190,817	190,817
Total	**378,727**	**376,007**	**370,957**	**365,930**	**360,885**	**355,858**	**350,778**

Notes: 1. The supply reported for reservoirs outside of Region B is only the amount of water that is supplied to water users in Region B.

Figure 3-1
Comparison of Firm Supplies to Supplies Available to Water Users



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CHAPTER 4

IDENTIFICATION, EVALUATION, AND SELECTION OF WATER MANAGEMENT STRATEGIES

TEXAS STATE WATER PLAN

REGION B

SEPTEMBER 2010

IDENTIFICATION, EVALUATION, AND SELECTION OF WATER MANAGEMENT STRATEGIES
TEXAS STATE WATER PLAN
REGION B

4.1 Comparison of Supply and Demand

A comparison of current supply to demand was performed using the projected demands developed in Chapter 2 and the allocation of existing supplies developed in Chapter 3 as evaluated under drought of record conditions. As discussed in Chapter 3, allocations of existing supplies were based on the most restrictive of current water rights, contracts, and available yields for surface water and historical use and groundwater availability for groundwater. The allocation process did not directly address water quality issues such as nitrates. Salinity was addressed to some extent by not assigning supplies with known high salinity levels for municipal use. This included most of the Blaine Aquifer. Further discussion of water quality issues and the effect on supply is presented in Section 4.3.

As a region, there is adequate supply to meet the region's needs until 2020. A small shortage begins by 2020, and increases to over 16,000 acre-feet per year by 2060. A comparison of the total regional supply to demand is shown on Figure 4-1. Comparisons for the three largest water use types, irrigation, municipal, and steam electric power are shown on Figures 4-2 through 4-4.

A summary of the projected needs by county are presented in Table 4-1. The comparison of supply versus demands by user group for Region B is presented in the Water User Group Summary Tables in Appendix A. There are eight water user groups with identified shortages that cannot be met by existing infrastructure and supply. These shortages total 40,366 acre-feet per year by 2060. Of this amount, over 98 percent of the shortage is associated with reduced supplies in the Lake Kemp and Diversion system. Table 4-2 lists the water user groups with projected water shortages.

Figure 4-1
Supply and Demand for Region B

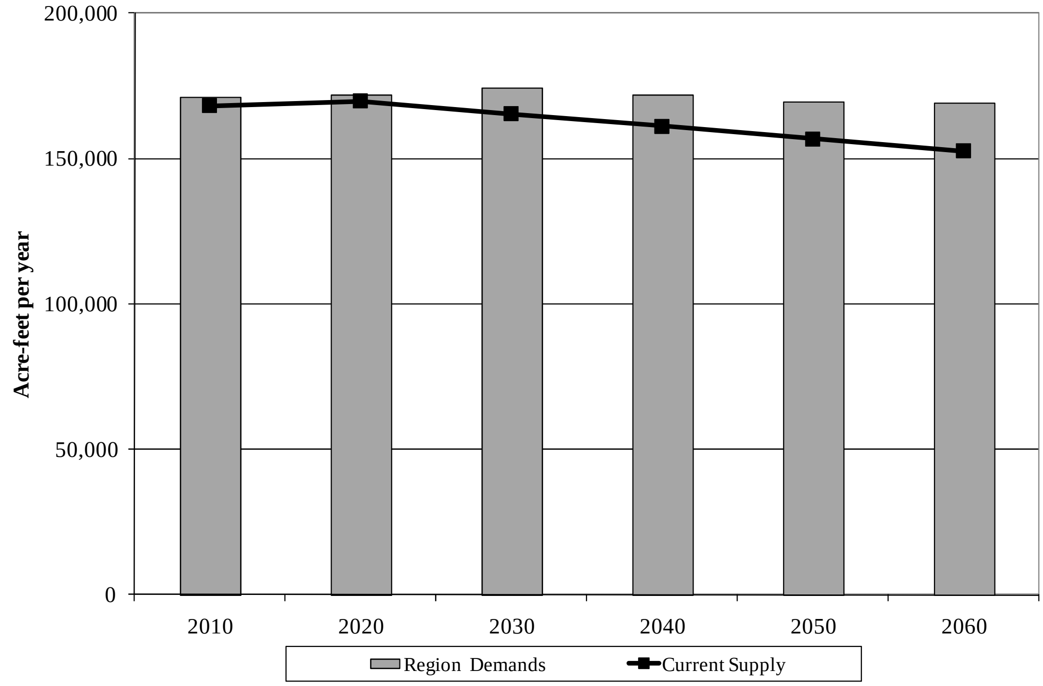


Figure 4-2
Irrigation Supply and Demand for Region B

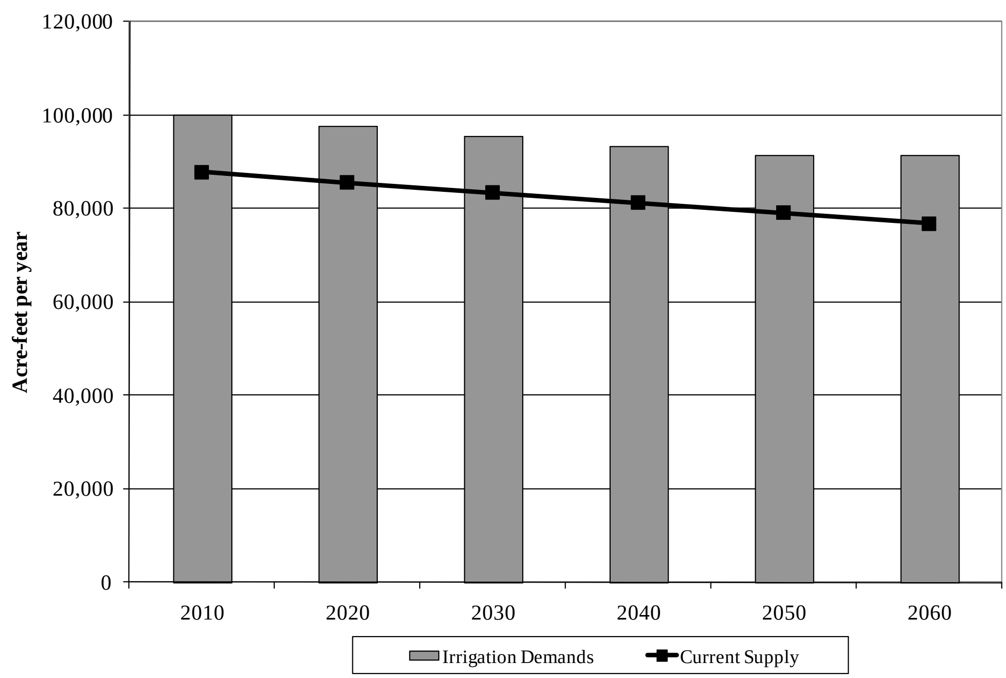


Figure 4-3
Municipal Supply and Demand for Region B

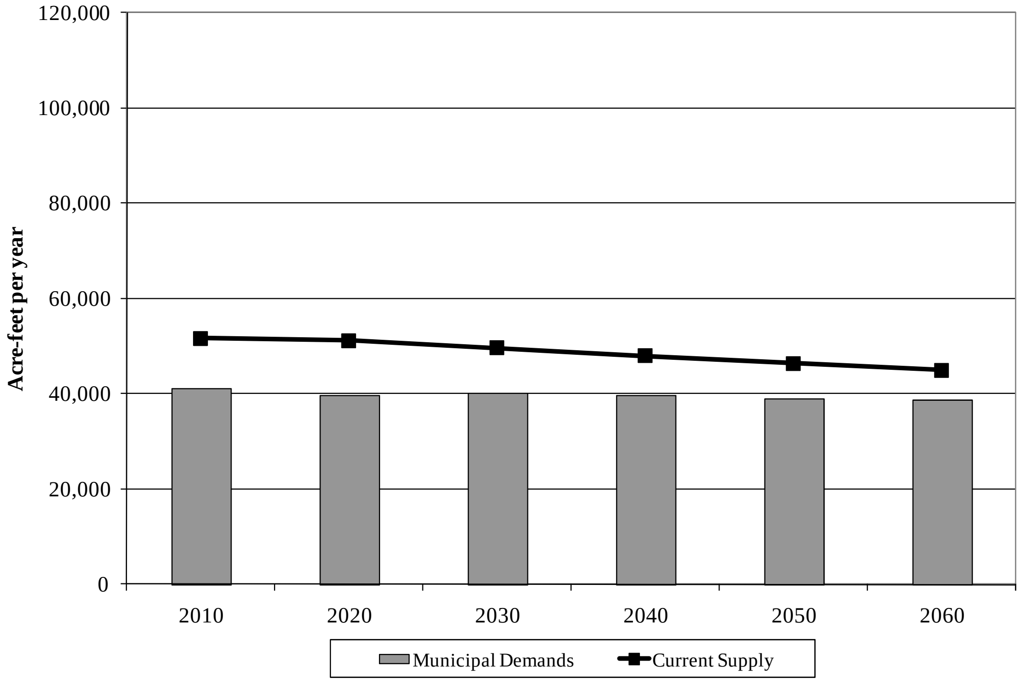


Figure 4-4
Steam Electric Power Supply and Demand for Region B

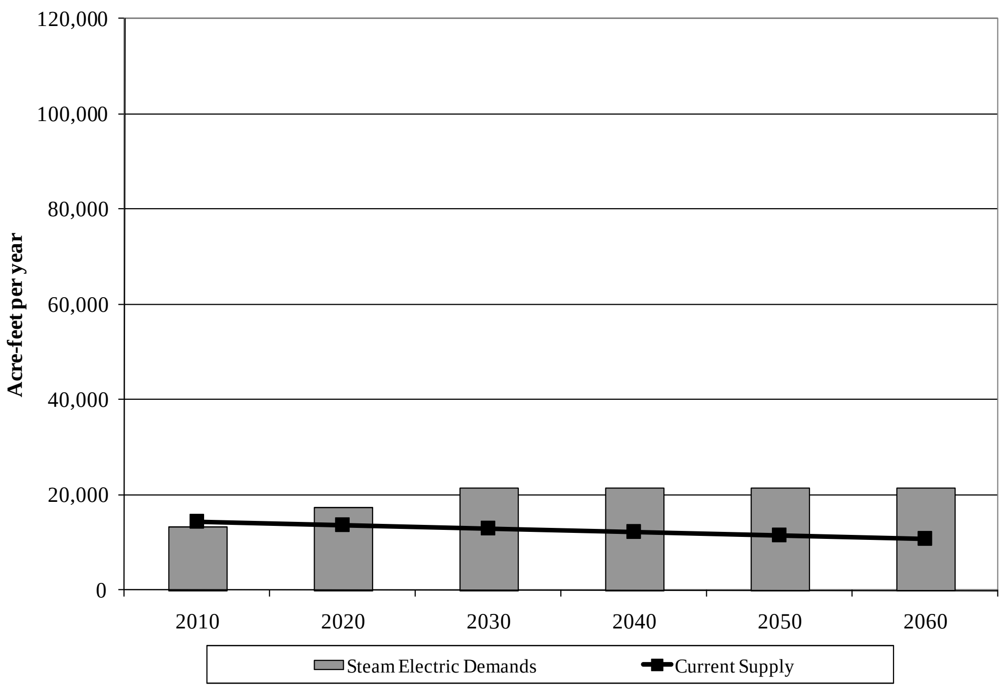


Table 4-1
Comparison of Supply and Demand by County
-Values are in Acre-feet per Year-

County	2010	2020	2030	2040	2050	2060
Archer	-499	-534	-620	-677	-655	-754
Baylor	1,905	2,011	2,115	2,187	2,238	2,284
Clay	318	401	482	646	904	994
Cottle	684	832	980	1,126	1,262	1,271
Foard	546	691	833	975	1,111	1,117
Hardeman	1,139	1,292	1,448	1,594	1,736	1,745
King	377	368	373	387	394	400
Montague	547	486	441	377	327	251
Wichita	-12,207	-13,464	-16,575	-18,842	-21,098	-24,567
Wilbarger	9,734	5,509	1,288	1,088	909	349
Young (P)	254	276	294	314	330	336
Region	**2,798**	**-2,132**	**-8,941**	**-10,825**	**-12,543**	**-16,575**

Note: County surplus/shortages were calculated from the sum of the county's supplies less the county projected demand. The sum of individual water group shortages may differ. These are shown in Table 4.2.

Table 4-2
Projected Water Shortages for Water User Groups
-Values are in Acre-feet per Year-

Water User Group	2010	2020	2030	2040	2050	2060
County-Other - Archer	-162	-126	-161	-187	-142	-136
Irrigation - Archer	-1,301	-1,344	-1,386	-1,426	-1,465	-1,584
County-Other - Clay	-45	-25	-8	0	0	0
Irrigation - Clay	-349	-331	-309	-284	-253	-274
County-Other - Montague	-224	-280	-295	-304	-290	-295
Mining - Montague	-177	-153	-145	-149	-162	-162
Irrigation - Wichita	-21,296	-22,252	-23,215	-24,184	-25,159	-27,201
Steam Electric Power - Wilbarger	0	-3,800	-8,529	-9,258	-9,987	-10,715
TOTAL	**-23,554**	**-28,311**	**-34,047**	**-35,792**	**-37,458**	**-40,366**

4.1.1 Evaluation of Safe Supply

While many water user groups were not identified with a shortage, several were found to have little to no supplies above the projected demands. The Region B Regional Water Planning Group recognized that these entities were likely to need to develop new supplies to provide a safe level of supply. To determine which entities may be impacted, a safe supply was defined as being able to meet the projected demands plus 20 percent of the demand. This was applied only to municipal and manufacturing water user groups. Using these criteria, eight water users were identified with safe supply shortages.

Table 4-3 Water
Users with Safe Supply Shortages
-Values are in Acre-feet per Year-

	2010	2020	2030	2040	2050	2060
County-Other - Archer	-269	-223	-265	-296	-242	-235
Lakeside City	-3	0	-12	-7	0	0
County-Other - Clay	-223	-199	-179	-79	0	0
County-Other - Montague	-485	-554	-572	-584	-567	-572
Iowa Park - Wichita	-229	-204	-202	-202	-202	-211
Wichita Falls - Wichita	0	0	-181	-1,467	-2,745	-4,204
Manufacturing – Wichita	-357	-383	-409	-439	-462	-462
Bowie - Montague	0	0	0	-50	-103	-171

4.1.2 Comparison of Supply and Demand for Wholesale Water Providers

The City of Wichita Falls is the only wholesale water provider in Region B. It is a regional provider for much of the water in Wichita, Archer, and Clay Counties. Considering current customer contracts and city demands, Wichita Falls has sufficient supplies to meet the projected firm needs and existing contractual obligations. The City has a projected shortage of 4,876 acre-feet per year to meet safe supply needs. This includes providing for the safe supply shortages shown for Iowa Park and Wichita County Manufacturing. A summary of the supply and demand comparison for Wichita Falls is shown in Table 4-4. A more detailed analysis is included in Appendix A.

Table 4-4
Projected Water Shortages for the City of Wichita Falls
-Values are in Acre-feet per Year-

	2010	2020	2030	2040	2050	2060
Total Current Customer Demand	38,735	37,593	38,642	38,669	38,686	38,882
Total Supplies	40,981	39,721	38,462	37,202	35,942	34,679
Supplies Less Current Customer Demand	2,246	2,128	-180	-1,467	-2,744	-4,203
Potential Future Customer Demand	589	587	622	648	664	672
Supplies Less Current and Future Customer Demand	1,657	1,540	-802	-2,114	-3,407	-4,875

4.1.3 Effect of Water Quality on Supply

Water quality is a significant issue in Region B. Due to limited resources, some user groups are using water of impaired quality or having to install additional treatment systems to utilize existing sources. An implied assumption of the supply analysis is that the quality of existing water supplies is acceptable for the listed use. In other words, water supplies that are currently being used are assumed to continue to be available, regardless of the quality. Senate Bill 1 requires that water quality issues be considered when determining the availability of water during the planning period. For this report, evaluations of source water quality are generally confined to waters used for human consumption. The effect of water quality of Lake Kemp on agricultural use is also reviewed.

<u>Municipal Water Systems with Existing or Potential Quality Concerns</u>

To determine whether the quality of specific sources of supply imposes a potential limitation on their use, the quality of the major sources of supply was compared to current and proposed drinking water standards. Pursuant to the Federal Safe Drinking Water Act, the U.S. Environmental Protection Agency (EPA) has adopted maximum contaminant levels (MCLs) for a list of organic and inorganic contaminants of drinking water. This list constitutes the primary drinking water standards, and water used for human consumption is to comply with the MCLs established by this list. The list of primary drinking water standards has recently been revised by EPA to include the addition of MCLs for contaminants not previously listed and the lowering of MCLs for other regulated contaminants (e.g., arsenic).

The Texas Commission on Environmental Quality (TCEQ) identifies systems that are not compliant with current and proposed primary drinking water standards. This list was reviewed for water users in Region B. Compliance with secondary drinking water standards was not evaluated since the secondary standards do not have the same regulatory and public health implications. Also, compliance with the bacteriological standards (total coliform and fecal coliform) was not evaluated since violations of these standards, when they occur, are typically associated with operational techniques and not the quality of the raw water supply. The water systems in Region B that have existing or potential non-compliances are identified in Table 4-5, along with the parameter of concern.

Table 4-5
Water Systems Not Compliant with Primary Drinking Water Quality Standards

Water System	County	Water Source	CURRENT STANDARD NO_3 MCL = 10 mg/L
Charlie WSC	Clay	Seymour Aquifer	X
Lockett Water System	Wilbarger	Seymour Aquifer	X
Hinds-Wildcat Water System	Wilbarger	Seymour Aquifer	X

The TCEQ records indicate that the only primary drinking water standard (other than bacteriological) currently exceeded by water users in Region B is the nitrate criterion. Three water users have water supplies that exceed the MCL for nitrate. During the last planning cycle there were concerns that several systems that may not comply with EPA's revised drinking water standard for arsenic. This was in part due to the uncertainty of the recommended maximum concentration for the revised standard. Since then the EPA set the new arsenic standard at 0.010 mg/L. At this level, there are no known water quality concerns for arsenic for Region B water providers.

Nitrate Concerns

The nitrate MCL is 10 mg/L. Consumption of water with nitrate levels in excess of 10 mg/L by infants can cause methemoglobinemia or "blue baby syndrome", a potentially fatal condition. Additionally, pregnant women are urged not to drink water with a high concentration of nitrates because of the potential health effects on the unborn fetus.

In Region B, moderate to high nitrate levels are found in water from the Seymour Aquifer. These concentrations are partly attributed to agricultural activities in the area. Long-standing practices associated with fertilizing crops are believed to have caused an increase in nitrates in the groundwater. Not all water produced from the Seymour Aquifer has excessive nitrates, but the water users shown in Table 4-5 have historically exhibited nitrate concentrations that range from slightly above the MCL of 10 mg/L to over 25 mg/L, in some cases.

Removal of nitrates from water can be expensive. Reverse osmosis or a comparable advanced membrane technique is required. Nitrates can also be reduced by blending the water with another water source with low nitrate levels, if such a source is available and otherwise of acceptable quality. The TCEQ currently is urging all water systems in the region using water with high nitrate levels to reduce the nitrate concentration by treatment, by blending, or by securing an alternate source of water. Deadlines for these water users to achieve the drinking water standard for nitrate have not been set. However, it can be expected that the TCEQ will continue to work toward achieving this goal and may eventually set deadlines for compliance.

Salinity Concerns for Lake Kemp and Diversion Lake

Waters in the Wichita River Basin have historically exhibited high dissolved solids and chloride concentrations. Previous studies, dating back to 1957, have documented that the salt concentrations in the area significantly limit the use of these waters for municipal, industrial, and irrigation purposes.

The U.S. Army Corps of Engineers (USACE) determined that an average of over 3,600 tons per day of chlorides was being discharged to the Red River system from natural and man-made sources. A project, known as the Chloride Control Project, has been designed to reduce the amount of salt contamination from eight of the Red River Basin's natural salt sources; three of which lie within the Wichita River Basin. To date, only one of the proposed chloride control facilities has been constructed and is operational. This low-flow dam structure on the South Wichita River (within the Lake Kemp drainage basin) retains low flows that are high in salts, and diverts them via a pump station and pipeline to Truscott Brine Reservoir. Low-flow diversion dams are also planned for the Middle and North Wichita Rivers. When constructed, high chloride water that would normally flow to Lake Kemp and Lake Diversion would be diverted to Truscott Brine Reservoir.

Recent water quality data of the Lake Kemp/Diversion system indicate that chloride levels have reduced since completion of the first chloride control project, but they still limit the water use. The primary uses impacted by the lakes' salt content are potable water supplies and irrigation.

Water quality criteria established pursuant to the Safe Drinking Water Act considers high salt content aesthetically undesirable, and is regulated under the secondary drinking water standards. Chloride, sulfate, and total dissolved solids concentrations are subject to the secondary standards. The TCEQ established criteria for these parameters that are somewhat higher than EPA criteria, and water systems in Texas are subject to the state criteria. Both the TCEQ and EPA standards and typical Lake Kemp levels for these parameters are presented in Table 4-6.

Table 4-6
Secondary Drinking Water Standards and Salinity Levels for Lake Kemp

Parameter	TCEQ Criteria	EPA Criteria	Lake Kemp/Diversion Typical concentration
Chloride (mg/L)	300	250	800 – 1,200
Sulfate (mg/L)	300	250	550 - 800
Total Dissolved Solids (mg/L)	1,000	500	2,000 – 3,500

It is sometimes possible to use water with salt concentrations that exceed the drinking water criteria by blending it with waters with lower salt content. This practice has been used in the Wichita River Basin, but is often limited to emergency use only. At the present time, a blend containing less than 25 percent of the waters from Lake Kemp or Diversion Lake is typically necessary if TCEQ criteria are to be achieved. This obviously limits the extent to which waters from these reservoirs can be used for potable supply without advanced treatment. For this reason, Wichita Falls has constructed an R.O. System to treat water from Lake Kemp.

The salinity of irrigation water from Lake Kemp can also limit the crops to which it can be applied. There are several systems for classifying the salinity of waters that characterize the suitability of the water for various types of crops. One classification system developed by the U.S. Department of Agriculture (USDA) in 1954 identifies four classes of water, based on the chloride concentration of the water, and describes the suitability of each class for irrigation. The classes and their corresponding description of suitability are as follows:

Class I – Low Salinity Water (Chloride < 250 mg/L)
Water is considered excellent to good and suitable for most plants growing on most soils with little likelihood that soil salinity will develop.

Class II – Medium Salinity Water (Chloride > 250 mg/L, but < 750 mg/L)
Water can be used if a moderate amount of leaching occurs. Plants with moderate salt tolerance can be grown in most cases without special practices for salinity control.

Class III – High Salinity Water (Chloride > 750 mg/L, but < 2,150 mg/L)
Water cannot be used on soils with restricted drainage. Even with adequate drainage, special management for salinity control may be required, and plants with good salt tolerance should be selected.

Class IV – Very High Salinity (Chloride > 2,150 mg/L)
Water is not suitable for irrigation under ordinary conditions, but may be used occasionally under very special circumstances. Only very salt tolerant crops should be selected.

The water in Lake Kemp and Diversion Lake is generally Class III. Therefore, its use for irrigation is limited to plants with high salt tolerance. The USDA Plant Sciences Group has performed research on the salt tolerance of various herbaceous crops, and examples of salt tolerant crops include cotton, barley, sugar beet, Bermuda grass, and asparagus.

4.1.4 System Limitations

In addition to water supply and water quality issues, system limitations were identified for the municipalities within the region. System limitations include water treatment plant design capacity, major water transmission pipelines, and associated pumping facilities. Distribution systems and storage facilities within a community were not addressed.

Municipal water systems are typically designed for peak flow conditions. The water supply analysis presented in Section 4.1 considered average day conditions and did not address limitations associated with peak demands. To assess limitations associated with treatment capacities for the municipalities in Region B, a peaking factor was applied to the average day demands developed in Chapter 2. Several of the larger municipalities provided this peaking factor based on historical use and these are shown on Table 4-7. For those users without a known peaking factor, a factor of 2 was assumed.

Water treatment plant capacities for surface water treatment were obtained from a TCEQ database (TCEQ, 2009). Transmission pipeline capacities were estimated from pipe diameters and average flow velocities. The water users provided the pumping capacities for the major transmission systems. Water treatment plant capacities were evaluated for all users who receive treated water from that system. For example, for the City of Wichita Falls, the sum of the peak demands for all treated water customers was compared to the City's water treatment plant's capacity. In addition to the physical system limitations, a comparison of available supply to peak demands was made for those entities with a contract that specified a peak demand limit (e.g., City of Wichita Falls customers).

Table 4-7
Peak Day Demands

Water User Group	Average Day Treated System Demands (MGD)	Peaking Factor[1]	Peak Day Demand (MGD)	Treatment Plant Capacity (MGD)
Archer City	0.32		0.64	1.08
Seymour/Baylor WSC	0.79		1.58	4.68
Byers	0.07		0.14	0.42
Henrietta	0.64	2	1.28	1.94
Petrolia	0.08		0.16	0.24
Paducah	0.28		0.56	1.7
Chillicothe	0.1		0.2	0.45
Bowie	1.13	2.25	2.54	4.60
Nocona	1	1.66	1.66	2.45
Saint Jo	0.09		0.18	0.69
Burkburnett	2.1	1.7	3.57	4.78
Wichita Falls	25.26	2.25	56.84	68.0
Vernon	3.26		6.52	9.41
Olney	0.63	1.87	1.18	1.72

1. For those cities without a given peaking factor, a factor of 2 was assumed.

As shown on Table 4-7, the municipalities in Region B appear to have sufficient capacities to transport and treat peak demands. The City of Wichita Falls is currently expanding their treatment capacity by 10 mgd to serve additional customers that have requested treated water.

The City of Iowa Park is no longer treating raw water from its lakes at this time. The City has installed an alternate transmission line and increased the water supply from Wichita Falls to provide the ability to use only treated water from Wichita Falls. The City of Seymour and Baylor WSC use groundwater from the Seymour Aquifer and share a water treatment plant. These entities are considering an interconnection to Millers Creek Reservoir that would provide water during a drought.

4.1.5 Summary of Needs

In Region B, water supply needs were identified for three different categories: quantity, quality, and reliability. As shown on Table 4-8, a total of 17 water user groups were identified with one or more of these need categories. Eight water user groups were identified with firm quantity needs. An additional four water user groups have projected safe supply shortages, and four municipal suppliers were found to have water quality and reliability issues.

Table 4-8

Water Users with Identified Needs

		Water Supply Needs		
User	**County**	**Quantity**	**Quality**	**Reliability**
County Other	Archer	X		
Lakeside City	Archer	X		
Irrigation	Archer	X	X	
Baylor WSC	Baylor	X	X	X
County Other	Clay	X	X	
Charlie WSC	Clay		X	
Irrigation	Clay	X	X	
County Other	Montague	X		
Bowie	Montague	X		
Mining	Montague	X		
Irrigation	Wichita	X	X	
Iowa Park	Wichita	X		
Manufacturing	Wichita	X		
Wichita Falls	Wichita	X		
Lockett Water System	Wilbarger	X	X	X
Hinds-Wildcat System	Wilbarger		X	X
Steam Electric Power	Wilbarger	X		

4.1.6 Economic Impacts of Not Meeting Needs

Section 357.7(4) of the rules for implementing Texas Senate Bill 1 requires regional water planning groups to evaluate the social and economic impacts of projected water shortages (i.e., "unmet water needs") as part of the planning process. The rules contain provisions that direct the Texas Water Development Board (TWDB) to provide technical assistance to complete socioeconomic impact assessments. In response to requests from regional planning groups, staff of the TWDB's Office of Water Resources Planning designed and conducted analyses to evaluate socioeconomic impacts of unmet water needs. This evaluation report has not been conducted to date, but will be included in the final report in Attachment 4-3.

4.2 Identification and Evaluation of Water Management Strategies to Meet Needs

4.2.1 Evaluation Procedures

For each water user group with a need the recommended strategies in the 2007 State Water Plan were reviewed for applicability and updated as needed. For new water needs or changed conditions, the consultants analyzed how the water user might best meet its needs and identified various potentially feasible water management strategies for consideration and priority ranking by the water user groups and the Regional Water Planning Group (RWPG). In accordance with regional water planning guidance, each of the potentially feasible strategies was then evaluated with respect to:

- Quantity, reliability and cost
- Environmental factors
- Impacts on water resources and other water management strategies
- Impacts on agriculture and natural resources
- Other relevant factors.

The other considerations listed in TAC 357.7(a), such as inter-basin transfers and third party impacts due to voluntary redistribution of water, were not specifically reviewed because they were not applicable to strategies identified for Region B needs.

The definition of quantity is the amount of water the strategy would provide to the respective user group in acre-feet per year. This amount is considered with respect to the user's projected safe supply needs. Reliability is an assessment of the availability of the specified water quantity to the user over time. If the quantity of water is available to the user all the time, then the strategy has a high reliability. If the quantity of water is contingent on other factors, then the reliability will be lower. The assessment of cost for each strategy is expressed in dollars for water delivered and treated for the end user requirements in acre-feet per year. Calculations of these costs follow regional water planning guidelines for cost considerations, and identify capital and annual costs by decade. Project capital costs are based on September, 2008 price levels, and include construction costs, engineering, land acquisition, mitigation, right-of-way, contingencies, and other project costs. Annual costs include power costs associated with transmission, water treatment costs, water purchase (if applicable), operation and maintenance, and other project-specific costs. For Region B projects, all debt service was calculated over 20 years at a 6 percent interest rate, except for Lake Ringgold, and the Chloride Control projects which were calculated over 40 years.

Potential impacts to sensitive environmental factors were considered for each strategy. Such sensitive environmental factors included wetlands, threatened and endangered species, unique wildlife habitats, effects on environmental water needs, and cultural resources. In an attempt to quantify the impact of each strategy, existing environmental reports were reviewed in addition to cursory environmental surveys in the area of the proposed project. Based on the above stated environmental factors, each strategy was evaluated as to whether the strategy would create a low impact, moderate impact, or high impact. If a strategy is selected, a more detailed environmental evaluation may be required.

The impact on water resources considers the effects of the strategy on water quantity, quality, and use of the water resource. A water management strategy may have a positive or negative effect on a water resource. This review also evaluated whether the strategy would impact the water quantity and quality of other water management strategies identified.

A water management strategy could potentially impact agricultural production or local natural resources. Impacts to agriculture may include reduction in agricultural acreage, reduced water supply for irrigation, or impact to water quality as it affects crop production. Some strategies may actually improve agricultural production. The impacts to natural resources may consider inundation of parklands, impacts to exploitable natural resources (such as mining), recreational use of a natural resource, and other strategy-specific factors.

Other relevant factors include regulatory requirements, political and local issues, public support, time requirements to implement the strategy, recreational impacts of the strategy, and other socio-economic benefits or impacts.

Strategies for Region B were developed to provide water of sufficient quantity and quality that is acceptable for its end use. As shown on Tables 4-5 and 4-6, water quality is a concern for several water sources in Region B. Water quality issues affect water use options and treatment requirements. For the evaluations of the strategies, it was assumed that the final water product would meet existing state water quality requirements for the specified use. For example, a strategy that provides water for municipal supply would meet existing drinking water standards, while water used for mining may have a lower quality. Strategies that improve water quality of other existing supplies, such as chloride control projects, were also considered.

A summary of the evaluation of the potentially feasible strategies in Region B is presented in Attachment 4-1 at the end of this chapter. The associated costs for each strategy are presented in Attachment 4-2.

4.2.2 Conservation

As required by Senate Bill 2, water conservation must be considered when developing water management strategies for water user groups with needs. Generally water conservation was not included in the projected demands for non-municipal water uses in Region B. An expected level of conservation is included in the municipal demand projections due to the natural replacement of inefficient plumbing fixtures with low flow fixtures, as mandated under the State Plumbing Code. For Region B, the total municipal water savings associated with plumbing fixtures is approximately 14.3 percent of the projected demand if no conservation occurred. Additional conservation savings can potentially be achieved in the region through the implementation of conservation best management practices. It is assumed that entities with low per capita water use will have minimal reductions in water use through conservation. In Region B there are seven municipal water user groups with identified safe supply shortages. Of these entities, Lakeside City and Montague County-Other have per capita water use below the screening criteria of 140 gallons per person per day. Municipal conservation strategies, with the exception of passive strategies, will not be evaluated for these user groups. Water savings from passive management strategies should occur without additional cost or effort from the water user.

Conservation strategies appropriate for Region B were evaluated based on the best management practices identified through the State Water Conservation Implementation Task Force. The Task

Force identified 21 municipal conservation strategies and 15 strategies for industrial water users. In addition there are new federal regulations that require new clothes washers to be energy efficient which may reduce water use. After review and consideration of these strategies, the recommended municipal conservation package consists of four management practices:

- Public and School Education
- Reduction of Unaccounted for Water through Water Audits
- Water Conservation Pricing
- Federal Clothes Washer Rules

Best management practices not selected include rebate programs, accelerated plumbing fixtures replacements, and specific outdoor watering measures. The benefits of outdoor watering strategies were assumed to be accounted under the public and school education practice. Also, many of the entities in Region B already use restrictions on outdoor watering as a drought management measure. Accelerated fixture replacements do not reduce the ultimate water need, but could delay when the need begins. In Region B, the largest municipal water user, Wichita Falls, has safe supply water needs beginning in 2030. No additional savings can be achieved through accelerated implementation of plumbing fixtures. This is also true for rebate programs that simply accelerate the already assumed conservation savings. The likelihood of implementing rebate programs in rural communities is low and previous studies have shown these programs to be relatively costly per acre-foot of water saved.

Where possible, reuse will be considered as a strategy for this need. For the irrigation and steam electric power needs associated with shortages in Lake Kemp, conservation through reductions in transmission losses in the irrigation canal system will be considered. This strategy is discussed in Section 4.2.5.

A summary of the water savings projected from conservation measures is shown in Table 4-9. The savings expressed as a percentage of the projected water demands are shown in Table 4-10. Strategies that are required by federal (clothes washer rules) or state (water audits) regulations were assumed to be implemented in accordance with these regulations. Other conservation practices were assumed to be implemented in the decade the entity was found to have a water shortage. A more detailed discussion of the conservation savings and costs is included in Attachment 4-5 of the 2006 Region B Water Plan (Biggs & Mathews 2006)

Most of the savings shown in Table 4-9 are associated with the federal clothes washer rules that will require all new clothes washers to be energy efficient. This strategy assumes that every household that purchases a new clothes washer will reduce its water use by 5.6 gallon per person per day at no additional cost to the water provider; however, it is uncertain as to whether this amount of savings will be realized by the respective entity. This strategy was evaluated for all user groups with an identified firm or safe need.

Table 4-9 Total Water Savings Associated with Conservation Strategies[1] (acre-feet per year)

Water User Group	2010	2020	2030	2040	2050	2060
Iowa Park	21	57	68	72	76	80
Wichita Falls	124	533	548	556	562	1,367
Bowie	8	34	34	61	69	72
Lakeside City[2]	3	9	10	11	11	11
Archer County-Other	7	11	14	16	17	18
Clay County-Other	16	42	45	45	41	39
Montague County-Other[2]	18	78	80	80	81	81

1. It is assumed that there are no savings directly from water audits. Savings are associated with system improvements as the result of water audits.
2. Only conservation savings associated with federal clothes washer rules are estimated for Montague County-Other because the per capita water use for these entities is less than 140. For Lakeside City, which also has per capita water use less than 140 gpcd, the values shown include savings from federal clothes washer rules and education programs. This is because the Lakeside City school system is shared with Archer County-Other. Benefits from a school education program that is implemented by Archer County-Other may also be realized by Lakeside City.

Table 4-10 Projected Water Savings as Percent of Municipal Demand

Water User Group	2010	2020	2030	2040	2050	2060
Iowa Park	1.72%	4.85%	5.76%	6.14%	6.51%	6.84%
Wichita Falls	0.54%	2.42%	2.40%	2.45%	2.48%	5.98%
Bowie	0.76%	3.43%	3.53%	6.43%	7.30%	7.64%
Lakeside City	0.58%	1.68%	1.93%	2.07%	2.11%	2.13%
Archer County-Other	1.27%	2.45%	2.78%	3.08%	3.46%	3.77%
Clay County-Other	1.84%	4.87%	5.25%	5.78%	6.77%	7.37%
Montague County-Other	1.76%	7.93%	8.26%	8.45%	8.56%	8.59%

The projected annual costs and cost per 1,000 gallons of water saved are shown in Table 4-11.

Table 4-11
Projected Costs for Municipal Water Conservation Strategies

Water User Group	Total Annual Costs					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Iowa Park	$15,436	$21,550	$21,550	$21,550	$21,550	$21,550
Wichita Falls	$1,187	$1,187	$1,187	$1,187	$1,187	$108,711
Bowie	$436	$436	$436	$16,550	$16,550	$16,550
Lakeside City	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000
Archer County-Other	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
Clay County-Other	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
Montague County-Other	$0	$0	$0	$0	$0	$0
	Cost per 1,000 Gallons of Water Conserved					
Iowa Park	$2.28	$1.15	$0.98	$0.92	$0.87	$0.83
Wichita Falls	$0.03	$0.01	$0.01	$0.01	$0.01	$0.24
Bowie	$0.17	$0.04	$0.04	$0.83	$0.74	$0.71
Lakeside City	$4.59	$1.66	$1.48	$1.39	$1.38	$1.37
Archer County-Other	$4.70	$2.70	$2.22	$1.90	$1.85	$1.72
Clay County-Other	$1.87	$0.72	$0.68	$0.69	$0.74	$0.78
Montague County-Other	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00

4.2.3 Municipal Water Strategies

There are 11 municipal users in Region B that have been identified with water needs relating to quantity, quality, or reliability. These users include Archer County (Other), Baylor WSC, Clay County (Other), Montague County (Other), City of Bowie, City of Iowa Park, City of Lakeside City, City of Wichita Falls, Charlie WSC, Hinds-Wildcat System, and Lockett Water System.

Potentially feasible water strategies were identified for each water user with needs along with their associated costs. Detailed cost estimates for each strategy are shown in Attachment 4-2.

Archer County (Other)

Archer County (Other) includes all areas within the county that are outside the service area of incorporated cities with population greater than 500 people or any other local water service provider.

Based on Tables 4-2 and 4-3, a water supply shortage is projected for Archer County (Other). Therefore, potentially feasible strategies were evaluated to meet a maximum firm supply of 187 acre-feet per year and a maximum safe supply of 296 acre-feet per year. Shortages are projected to begin in 2010 with maximum shortages projected by the year 2040.

With no known dependable groundwater supply in Archer County, the only potentially feasible strategy considered, in addition to conservation, was additional supply from an existing local provider. Depending on the demand location, the local provider would be one of the five current water user groups within Archer County or a smaller water provider that is included in the County-Other category.

For planning purposes it was assumed that as a minimum the local providers system would require an upgrade of approximately 10,000 LF of 6" line in addition to the costs of purchasing the additional required volume of treated water.

Quantity, Reliability, and Cost

A safe supply of 296 acre-feet per year can be made available from several of the current local providers within Archer County which have an excess supply of treated water throughout the planning period. The reliability of this source would be good in that the water purchased would be through a contractual obligation from a dependable local provider. For planning purposes, it is assumed that 30 percent of the needed supply would be obtained from Archer City Lake and the remainder would come from Wichita Falls sources.

As shown in the detailed cost estimates provided in Attachment 4-2, the capital costs for this strategy is $364,000 with an annual cost of $518,000 and an annual cost of water delivered per acre-foot of $1,750.

Environmental Impacts

Environmental impacts would be minimal assuming that the pipeline could be installed generally along public roads. There could likely be some creek crossings along the pipeline route, however, there are no major issues that are readily apparent at this level of study. (See Attachment 4-1).

Impacts on Water Resources and Water Management Strategies

The impacts to other resources and strategies with this project would be indirect. In order for the local providers to provide the required water to other portions of the county, the local provider would first have the water to sell. That may require the local provider to purchase additional water from an entity like the City of Wichita Falls or Archer City prior to entering into a contract to meet the additional water demand.

Impacts on Agricultural and Natural Resources

With the only anticipated construction being water line improvements along public roads, only minimal agricultural and natural resources impacts are anticipated.

Other Relevant Factors

No other relevant factors regarding this strategy have been identified at this time.

Clay County (Other)

Clay County (Other) includes all areas within the county that are outside the service area of incorporated cities or any other local water service provider.

Based on Tables 4-2 and 4-3, a water supply shortage is projected for Clay County (Other). Therefore, potentially feasible strategies were evaluated to meet a maximum firm supply of 45 acre-feet per year and a maximum safe supply of 223 acre-feet per year. These maximum shortages are projected by the year 2010.

With a very limited groundwater supply in Clay County, the only potentially feasible strategy considered, in addition to conservation, was additional supply from an existing local provider. Depending on the demand location, the local provider would be one of the five current water user groups within Clay County or one of the five smaller water providers that are included in the County-Other category.

For planning purposes it was assumed that as a minimum the local providers system would require an upgrade of approximately 10,000 LF of 6" line in addition to the costs of purchasing the additional required volume of treated water.

Quantity, Reliability, and Cost

A safe supply of 223 acre-feet per year can be made available from several of the current local providers within Clay County, which have an excess supply of treated water throughout the planning period. The reliability of this source would be good in that the water purchased would be through a contractual obligation from a dependable local provider. For planning purposes, it is assumed that all of this supply would be obtained from Wichita Falls sources.

As shown in the detailed cost estimates provided in Attachment 4-2, the capital costs for this strategy is $364,000 with an annual cost of $326,000 and an annual cost of water delivered per acre-foot of $1,462.

Environmental Impacts

Environmental impacts would be minimal assuming that the pipeline could be installed generally along public roads. There could likely be some creek crossings along the pipeline route, however there are no major issues that are readily apparent at this level of study. (See Attachment 4-1).

Impacts on Water Resources and Water Management Strategies

The impacts to other resources and strategies with this project would be indirect. In order for the local providers to provide the required water to other portions of the county, the local provider would first have the water to sell. That may require the local provider to purchase additional water from an entity like the City of Wichita Falls prior to entering into a contract to meet the additional water demand.

Impacts on Agricultural and Natural Resources

With the only anticipated construction being water line improvements along public roads only minimal agricultural and natural resources impacts are anticipated.

Other Relevant Factors

No other relevant factors regarding this strategy have been identified at this time.

Montague County (Other)

Montague County (Other) includes all areas within the county that are outside the service area of incorporated cities or any other local water service provider.

Based on Tables 4-2 and 4-3, a water supply shortage is projected for Montague County (Other) beginning in 2010. Therefore, potentially feasible strategies were evaluated to meet a maximum firm supply of 304 acre-feet per year and a maximum safe supply of 584 acre-feet per year. These maximum shortages are projected by the year 2040. Therefore, two potentially feasible strategies were considered for Montague County (Other).

One option would be to develop additional groundwater supplies in the county. To meet the required demand utilizing groundwater it is anticipated that approximately six wells would need to be drilled in addition to ground storage, pumping facilities, and 10,000 LF of 6" transmission line.

A second option would be to provide additional supply from an existing local provider. Depending on the demand location, the local provider would be one of the three current water user groups within Montague County or smaller water suppliers that are included in the County-Other category. For planning purposes it was assumed that as a minimum the local providers systems would require an upgrade of approximately 10,000 LF of 6" line in addition to the costs of purchasing the additional required volume of treated water.

Quantity, Reliability, and Cost

A safe supply of 584 acre-feet per year can be provided by developing additional groundwater supply wells or by purchasing additional water from an existing local provider.

It is anticipated that the supply reliability from the local provider might be better than the groundwater supply since water levels tend to decline over time. For planning purposes, it is assumed that approximately 20 percent of new supply would come from the Trinity Aquifer, 40 percent from Lake Nocona and 40 percent from the City of Bowie.

As shown in the detailed cost estimate provided in Attachment 4-2, the capital costs for the additional groundwater supply is $2,283,500 with an annual cost of $359,000 and an annual cost of water delivered per acre-foot of $614.

In comparison, the capital cost for additional water from a local provider is $364,500 with an annual cost of $700,650 and an annual cost of water delivered per acre-foot of $1,200.

Environmental Impacts

Environmental impacts would be minimal for both strategies, assuming that the pipeline could be installed generally along public roads. There could likely be some creek crossings along the route, however, there are no major issues with either strategy that are readily apparent. (See Attachment 4-1).

Impacts on Water Resources and Water Management Strategies

With regards to developing an additional groundwater supply there would be a low impact on the existing water resources and no impact on other water management strategies.

The impacts to other resources and strategies with regards to additional water from a local provider would be indirect. In order for the local providers to provide the required water to other portions of the county the local provider must first have the water to sell. That may require the local provider to purchase additional water from an entity like the City of Bowie, City of Nocona or the City of Saint Jo prior to entering into a contract to meet the additional water demand.

Impacts on Agricultural and Natural Resources

In developing a groundwater supply well field, there is a potential that a small portion of agricultural land could be impacted. However, we believe the impact would be minimal.

With the local provider strategy and the only anticipated construction being the water line improvements along public roads, only minimal agricultural and natural resource impacts are anticipated.

Other Relevant Factors

No other relevant factors regarding either strategy have been identified at this time.

City of Bowie

The City of Bowie has a population of 5,219 and is located in the southwest portion of Montague County. The City currently utilizes Lake Amon Carter for its water supply and it is anticipated that this source will provide for an adequate firm supply through the year 2060.

However, based on Table 4-3, a safe water shortage is projected for the City of Bowie beginning in the year 2040. Therefore, potentially feasible strategies were evaluated to meet a maximum safe supply of 171 acre-feet per year projected for the year 2060.

In addition to conservation, two potentially feasible strategies were considered for the City of Bowie.

One option would be to develop groundwater supplies in the county. To meet the required demand utilizing groundwater it is anticipated that two wells would need to be drilled in addition to ground storage, pumping facilities and 10,000 LF of 6" transmission line.

A second option would be the reuse of treated wastewater. Currently the City discharges approximately 672 acre-feet per year of treated wastewater from their existing plant. With enhanced treatment and approximately 5,280 feet of conveyance pipe, this water could be reused by the City to meet current and future water demands.

<u>Quantity, Reliability, and Cost</u>

A safe supply of 171 acre-feet per year can be provided by developing groundwater supply wells or by constructing the appropriate treatment and conveyance facilities for wastewater reuse.

It is anticipated that the supply reliability from the wastewater reuse would be better than the groundwater supply since water levels tend to decline over time. In addition, there is some concern by the City with mixing groundwater and surface water.

As shown in the detailed cost estimate provided in Attachment 4-2, the capital costs for the additional groundwater supply is $1,650,000 with an annual cost of $205,000 and an annual cost of water delivered per acre-foot of $1,200.

In comparison, the capital cost for additional water from wastewater reuse is $1,206,500 with an annual cost of $162,500 and an annual cost of water delivered per acre-foot of $950.

Environmental Impacts

Environmental impacts would be minimal for both strategies, assuming that the pipeline could be installed generally along public roads. There could likely be some creek crossings along the route, however, there are no major issues with either strategy that are readily apparent. With regards to the wastewater reuse system, the treatment facility and pump station would both be located at the existing wastewater treatment plant. (See Attachment 4-1).

Impacts on Water Resources and Water Management Strategies

Development of an additional groundwater supply would be a low impact on the existing water resources and no impact on other water management strategies.

The wastewater reuse option would have a low to moderate impact on the receiving stream of the plant in that a portion of the effluent would be diverted.

Impact on Agriculture and Natural Resources

In developing a ground water supply there is a potential that a small portion of agricultural land could be impacted. However, it is anticipated that it would be minimal.

With the wastewater reuse option the impact would be minimal in that the pipeline would be installed along public roads and the treatment facilities would be located at the existing plant. Also, though some of the wastewater flow would be diverted, the impact would be minimal.

Other Relevant Factors

There are no other known relevant factors relating to the groundwater option, however, there could be an issue with public acceptance of a wastewater reuse system if perception prevails regarding health and safety concerns of utilizing wastewater.

City of Iowa Park

The City of Iowa Park has a population of 6,431 and is located in the central portion of Wichita County. Iowa Park has water rights in North Fork Buffalo Creek Lake and Lake Iowa Park. The City currently purchases treated water from the City of Wichita Falls. With the recent drought, the City of Iowa Park lakes went dry and the City was totally dependant on Wichita Falls for water. The City has discontinued using water from its other sources and uses only water from Wichita Falls.

Based on Table 4-3 a maximum safe supply shortage of 229 acre-feet per year is projected for Iowa Park in the year 2010.

Therefore in addition to conservation, the only potentially feasible strategy evaluated for the City of Iowa Park was to purchase additional treated water from the City of Wichita Falls. After a thorough investigation of their limited options, the City officials have determined that purchasing water from the City of Wichita Falls is their only viable option for a long term reliable source of water supply.

Quantity, Reliability, and Cost

A safe supply of 229 acre-feet per year can be made available from the City of Wichita Falls as Wichita Falls develops its recommended strategies. The reliability of this source would be good in that the water purchased would be through a contractual obligation. As shown in the detailed cost estimates provided in Attachment 4-2, the annual cost for this strategy is $242,500 with an annual cost of water delivered per acre-foot of $1,059.

Environmental Impacts

Environmental impacts would be minimal since no construction activity would be required. (See Attachment 4-1).

Impacts on Water Resources and Water Management Strategies

The impacts to other resources and strategies with this project would be indirect in that the City of Wichita Falls would be utilizing existing supply to provide for the City of Iowa Park.

Impacts on Agricultural and Natural Resources

With no construction activity anticipated there should be no agricultural and natural resources impacts.

Other Relevant Factors

No other relevant factors regarding this strategy have been identified at this time.

City of Lakeside City

The City of Lakeside City has a population of 984 and is located in the northern portion of Archer County. The City currently purchases treated surface water from the City of Wichita Falls which is their source of water supply. It is anticipated that their current supply will provide for an adequate firm supply through the year 2060.

However, based on Table 4-3, a safe water supply shortage is projected for Lakeside City by the year 2010. Therefore, potentially feasible strategies were evaluated to meet a maximum safe supply shortage of 12 acre-feet per year.

Since Lakeside City has a water usage below 140 gpcd, conservation was not considered as a strategy and with the relatively small amount of water needed the only strategy evaluated for Lakeside City was to purchase additional treated water from Wichita Falls. Wichita Falls has adequate line and pumping facilities and is capable of meeting the necessary safe supply requirement.

Quantity, Reliability, and Cost

A safe supply of 12 acre feet per year can be provided by purchasing the additional water from the City of Wichita Falls to meet this additional demand.

As shown in the detailed cost estimate provided in Attachment 4-2, there are no required capital expenditures for this strategy. However, with the purchase of water, the annual cost is estimated at $12,707 and the cost of water delivered per acre-foot is $1.059.

Impacts on Agricultural and Natural Resources

With there being no construction required and utilizing existing water conveyance facilities, only minimal agricultural and natural resources impacts are anticipated.

Environmental Impacts

With no construction required for this strategy there are no environmental impacts. (See Attachment 4-1).

City of Wichita Falls

The City of Wichita Falls is located in the southeastern portion of Wichita County and has a current population of 104,197. It is the largest city in a radius of about 100 miles, and the nearby communities and towns share economic and cultural ties to Wichita Falls.

The service area of Wichita Falls is approximately 65 percent of the entire Region B population and the municipal water demand on the Wichita Falls system accounts for approximately 65 percent of the total Region B municipal demand. With the majority of the municipal demand being dependent on the City of Wichita Falls for the next 50 years, it is imperative that management strategies be identified and evaluated to increase the system reliability. To provide for a more conservative estimate of the available surface water supply in Region B a safe yield analysis was conducted for each of the three existing surface water supply reservoirs. This analysis utilizes the same historical hydrology as firm yield, but assumes that a one-year supply of water is reserved at all times. The results of the safe yield analysis for the Wichita Falls surface water supply for the years 2010 to 2060 were estimated at 40,981 and 34,679 acre-feet per year respectively.

Based on the calculated safe supply less the current customer demand, and as shown in Table 4-3, the City of Wichita Falls is projected to have a 4,203 acre-feet per year safe supply shortage in the year 2060. This does not include any additional customer demands that are anticipated within the next three to five years or additional safe supply for Iowa Park and Wichita County Manufacturing. As shown in Table 4-4, with these additional demands, the projected safe supply shortage is 4,876 acre-feet per year.

Therefore, after consultation with the City of Wichita Falls, two potentially feasible strategies were evaluated to provide the City of Wichita Falls with an additional source of supply.

A Wastewater Reuse system could be constructed that would utilize approximately 11,000 acre-feet per year (10 MGD) of processed and treated effluent for irrigation purposes or mixed with the existing raw water supply at the secondary reservoir.

A second alternative for additional water supply would be to construct a new lake approximately 40 miles northeast of Wichita Falls near the town of Ringgold to provide an additional 27,000 acre-feet per year (24 MGD)

Quantity, Reliability, and Cost

Currently the City of Wichita Falls operates and maintains a wastewater treatment plant that discharges approximately 14,300 acre-feet per year (13 MGD) of very high quality treated effluent into the Wichita River for use downstream by other entities. This water would be a very reliable source for the City, and could be utilized to decrease the irrigation and industrial demands on the system, and/or to increase the municipal water by 11,000 acre-feet per year (10 MGD). To produce 10 MGD of reusable water, this alternative would require advanced treatment at the River Road Wastewater Treatment Plant (RRWWTP) including denitrification, microfiltration, and ultraviolet (UV) disinfection. In addition, a 30-inch pipeline and 10 MGD pump station will be required to convey the water to the secondary reservoir at the Jasper WTP.

With regards to the new lake strategy, the City of Wichita Falls identified a potential reservoir site approximately 40 miles northeast of Wichita Falls, near the town of Ringgold. The site would be on the Little Wichita River and previous studies have concluded that, if constructed approximately 27,000 acre-feet per year (24 MGD) of water could be made available for municipal use. An evaluation of Lake Ringgold using the Red River WAM found the firm yield to be 33,000 acre-feet per year, which assumes instream flow releases using the Consensus Method. (Referenced) This is more than previously estimated. For planning purposes, it is assumed that Lake Ringgold would be able to provide 27,000 acre-feet per year of firm supply. The safe yield is estimated at 24,000 acre-feet per year.

This reservoir would be in the same drainage basin as Lake Arrowhead and Lake Kickapoo so it is anticipated that the water quality would be very similar to the existing reservoirs. The reliability of this water supply would be good, however, with the location of the Ringgold site being downstream and in the same drainage basin as the two existing lakes, the Ringgold Reservoir could be adversely affected during periods of extended drought.

Of the 17,000 acres of land needed for the reservoir site, the City currently owns approximately 6,500 acres. Along with purchasing the remaining lands for the site, additional facilities including a lake intake structure, pump station facilities, and 40 miles of 54" transmission line would be required to convey 27,000 acre-feet per year (24 MGD) of raw water into existing treatment facilities in Wichita Falls. As shown in the detailed cost estimate provided in Attachment 4-2, the total capital costs for the wastewater reuse project is $57,100,000 with an annual cost of $8,467,000 and an annual cost of water delivered per acre-foot of $770.

For the construction of the Lake Ringgold Reservoir, the total capital cost is $382,900,000 with an annual cost of $38,014,500 and an annual cost of water delivered per acre-foot of $1,408

<u>Environmental Factors</u>

The wastewater reuse alternative would have low to moderate impacts on the environment since the pipeline route could be routed along the Holliday Creek Flood Control Project. In addition, the pump station would be located at the existing wastewater plant in an area of minimal impact. (See Attachment 4-1).

The Lake Ringgold alternative would have a moderate impact on the environment with the inundation of over 9,000 acres of existing pasture land. In addition, pump stations and the pipeline into the City should be located in areas of low to moderate impact. (See Attachment 4-1).

Impact on Water Resources and Other Management Strategies

The wastewater reuse alternative would have a low to moderate impact on the Wichita River in that the wastewater effluent would no longer be discharging into the river. During drought conditions this could cause a noticeable effect on the quantity and perhaps the quality of water in the Wichita River immediately downstream from the wastewater plant.

The Lake Ringgold alternative would have a high impact on the water resources of the City in that an additional 275,000 acre-feet of reservoir storage would be created, while increasing the water supply to Wichita Falls by 27,000 acre-feet per year. Also there would be a high impact to stream flows immediately downstream of the dam, however, this impact would be mitigated through instream flow release.

Though this alternative is the most expensive strategy, it would likely delay the need for the wastewater reuse project beyond the year 2060.

Impacts on Agriculture and Natural Resources

The wastewater reuse alternative would have a low impact on agriculture in that the location for the reuse facility would likely be at an existing site. However, the impact on natural resources is anticipated to be moderate to high in that wastewater flows would be diverted from the existing discharge stream.

The Lake Ringgold alternative would have a moderate to high impact on both Agriculture and Natural Resources in that approximately 17,100 acres of agriculture land could be required for the site and approximately 1,150 acres of wetlands could be impacted.

Other Relevant Factors

Public acceptance of the wastewater reuse may become an issue if perception prevails that properly treated wastewater effluent is a questionable source of raw water supply for the City due to unfounded health concerns or other misconceptions. In addition, this alternative will require a modification to the wastewater discharge permit which could take one to two years.

The construction of Lake Ringgold would require the City to obtain a permit from the State to impound and divert water from the Little Wichita River. It also would require a 404 permit from the Corps of Engineers to construct the dam.

Lake Ringgold will impound water within Assessment unit 02 (east fork confluence to the Lake Arrowhead dam) of stream segment 0211, which is identified on both the 2006 and 2008 Section 303(d) lists as not attaining the stream standard for dissolved oxygen. The segment is currently classified as 5b, indicating that a total maximum daily load (TMDL) assessment will be delayed pending conformation of the stream standard. A change in the stream standard could result in removal or delisting of this segment. However, construction of Lake Ringgold would most likely result in a somewhat higher stream standard for dissolved oxygen and potentially nutrients. There are currently three permitted wastewater discharges within or upstream of this assessment unit. These dischargers may be impacted by higher stream standards, requiring a higher level of treatment and nutrient removal. This is an environmental impact that will need to be considered in the planning and permitting effort for the reservoir. The reservoir is not required to satisfy water needs until 2050. Therefore, there is sufficient time to address modification of existing wastewater plants to achieve the future stream standards and satisfy protection of Lake Ringgold as a water supply reservoir.

Charlie Water Supply Corporation

Charlie Water Supply Corporation is a small water system located in the northern portion of Clay County near the Red River that serves a population of approximately 90. The system currently utilizes a groundwater supply that will be adequate through 2060, however the nitrate levels in the water exceed State standards.

The only potentially feasible strategy evaluated for this user was to construct a nitrate removal treatment plant. The plant would be designed to provide 10 acre-feet per year of potable water that meets minimum state requirements.

Quantity, Reliability, and Cost

Constructing a nitrate removal plant would provide for 10 acre-feet per year for very reliable and good quality of water that meets minimum state standards.

As shown in the detailed cost estimate provided in Attachment 4-2, the capital costs for this strategy is $200,500 with an annual cost of $25,500 and an annual cost of water delivered per acre-foot of $2,550.

Environmental Factors

The environmental impacts would be low because there will be no discharge of the brine wastewater stream. Also, the salt concentration of the waste stream should not be very high. (See Attachment 4-1).

Impacts on Water Resources and other Water Management Strategies

There should be no water resource impacts since no additional water is used from the Seymour Aquifer. The nitrate removal system improves the water quality of the supply from the aquifer.

Impacts on Agriculture and Natural Resources

Impacts to agriculture should be low. A minimum of one acre of existing agricultural land would need to be purchased for the treatment plant and evaporation pond. No additional water would be pumped from the Aquifer. Therefore, there should be no additional impacts to agricultural supply.

Other Relevant Factors

This strategy could be implemented between two and five years. The permitting and regulatory requirements are expected to be moderate. The water treatment plant would require approval from TCEQ and the system would require a no discharge wastewater permit. An NPDES storm water permit will be required during construction. This alternative may require additional staff to maintain and operate the system. Also, the evaporation ponds may require periodic disposal of accumulated salt deposits.

Hinds-Wildcat and Lockett Water Systems

The Hinds-Wildcat and Lockett Water Systems are two existing systems owned and operated by the Red River Authority of Texas that provide water for a population of approximately 596 persons in Wilbarger County. The water supply for each system comes from the Seymour Aquifer, which has nitrate levels that exceed TCEQ requirements, therefore both systems employ a bottled water program for customers requiring low nitrate water.

The only strategy available to the Lockett System is to purchase treated water from the City of Vernon. In addition to purchasing water from the City of Vernon, another alternative for the Hinds-Wildcat System is to construct a nitrate removal plant.

Quantity, Reliability, and Costs

Constructing a nitrate removal plant for the Hinds-Wildcat System would provide 40 acre-feet per year of quality water and the reliability would be good.

Water purchased from the City of Vernon would provide a very reliable source to both systems, however, the costs would be substantially higher.

As shown in the detailed cost estimates provided in Attachment 4-2, the capital costs for Hinds-Wildcat treatment plant would be $446,500 with an annual cost of $54,500 and a cost of water delivered per acre-foot of $1,363 In comparison, the total capital costs to purchase water from Vernon would be $848,000 with an annual cost of $122,000 and a cost of water delivered per acre-foot of $3,050

In comparison, the total capital cost to purchase water from Vernon would be $1,658,700 with an annual cost of $247,000 and a cost of water delivered per acre-foot of $2,266.

Environmental Factors

The environmental impacts of the treatment plant would be low since there would be no waste discharged from the plant. Also, there would be minimal impacts due to pipeline construction assuming the route generally followed existing public roads. (See Attachment 4-1).

Impacts on Water Resources and Other Management Strategies

There are no anticipated impacts to water resources or other management strategies with either one of the alternatives.

Impacts on Agricultural and Natural Resources

Impacts agriculturally should be low. A minimum of one acre of existing agricultural land might be needed for the treatment plant site and evaporating pond. With all pipeline work being along public roads there would be minimal impact to agriculture or natural resources.

Other Relevant Factors

Construction of a treatment plant would require permitting by TCEQ which could take one to two years to complete.

4.2.4 Manufacturing Water Strategies

Wichita County Manufacturing

Region B has an adequate firm supply of water to meet the manufacturing needs through the 2060 planning period. However, as shown in Table 4-3 a safe supply shortage of 357 acre-feet per year is projected in Wichita County by the year 2010 and the shortage will increase to 462 acre-feet by the year 2050.

Currently, the City of Wichita Falls is supplying the most of the water for manufacturing in Wichita County and it is anticipated that Wichita Falls will provide the additional safe supply needed through 2060 to meet the future demands.

Quantity, Reliability, and Costs

With improvements through the 2060 planning period, the City of Wichita Falls can provide for a safe supply of 462 acre-feet per year to meet all the Wichita County manufacturing needs. Wichita Falls has sufficient supplies through 2020 to meet the need without any additional water management strategies. By 2030, the City will need to develop additional water supplies. These strategies are discussed under Wichita Falls.

4.2.5 Steam Electric Power and Irrigation Water Strategies

Steam Electric Power and Irrigation water use within Region B accounts for approximately 66% of the total usage. With this usage projected to continue, it is imperative that an adequate supply of water be made available through the year 2060.

<u>Archer, Clay, Wichita, and Wilbarger Counties</u>

Based on Table 4-2, it is anticipated that there will be a water shortage for steam electric power in Wilbarger County by the year 2020. This supply shortage is anticipated to be 10,715 acre-feet per year by 2060.

In addition, it is projected that beginning in 2010 there will be a shortage of irrigation water supply within Archer, Clay, and Wichita Counties. By the year 2060, it is projected that an additional 29,134 acre-feet per year of irrigation water will be needed within Region B.

The majority of the irrigation and steam electric water supply comes from Lake Kemp. As sedimentation increases within the lake, the supply capacity decreases. As noted in Chapter 3, the Lake Kemp safe supply is projected to decrease from 62,400 acre-feet per year in 2010 to 44,800 acre-feet per year in 2060. This relatively high rate of sedimentation was recognized by the Corps of Engineers during the re-design of the dam in 1973. The design memorandum for Lake Kemp considers raising the conservation elevation to a maximum of 1149.8 feet MSL to compensate for decreased capacity due to sedimentation. A permanent adjustment to the Lake Kemp conservation elevation would require a reallocation study. The Corps of Engineers, in conjunction with the TWDB, are currently reviewing the potential yield increases with reallocation. As an interim measure, Lake Kemp is currently allowed to store water up to elevation 1145.5 (1.5 ft. increase over normal conservation levels) during the months of April through October.

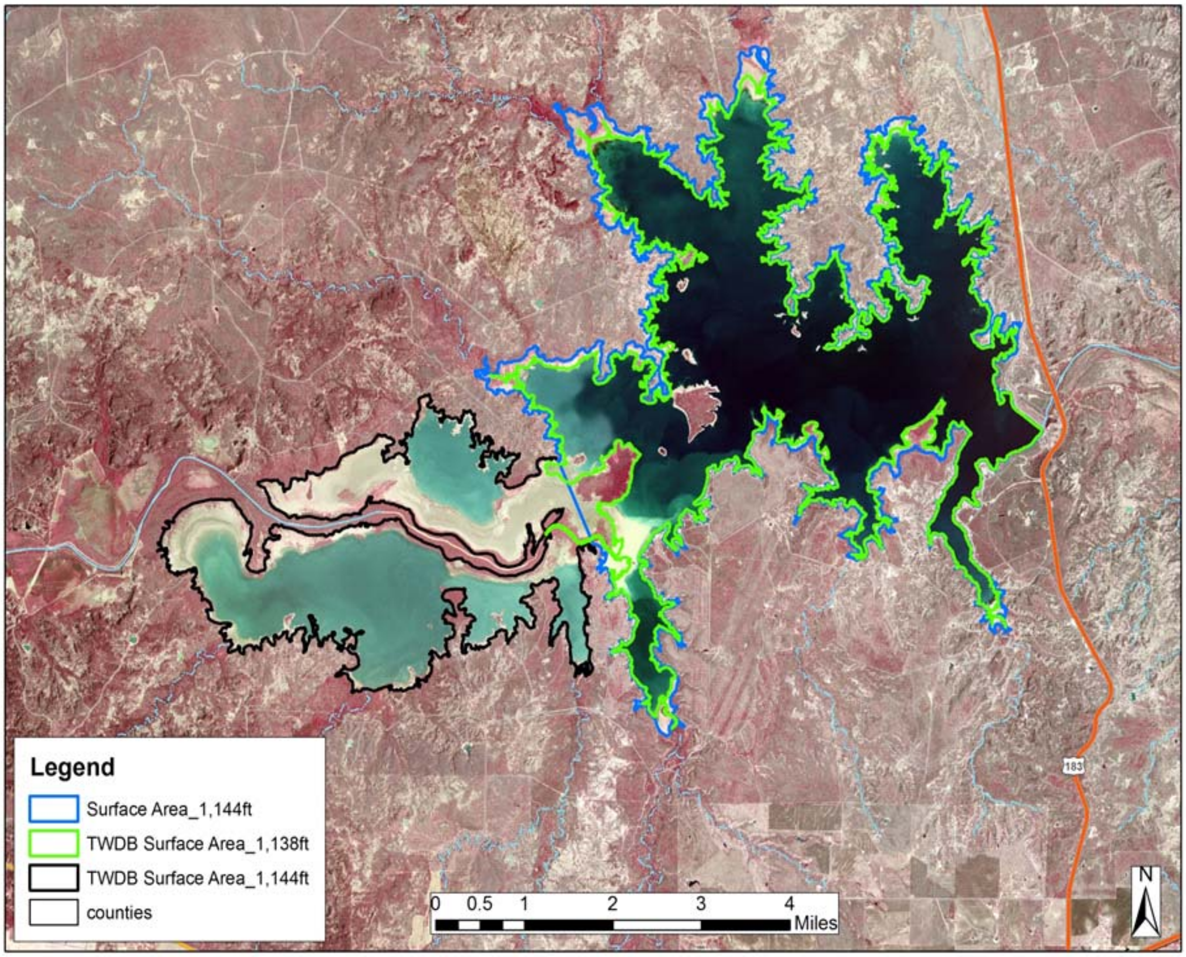
The water right for the Lake Kemp/Diversion System allows the Wichita County Water Improvement District (WCWID #2) to divert a portion of the irrigation right (16,660 acre-feet per year of the permitted 120,000 acre-feet per year) directly from the Wichita River for irrigation purposes. The supply from this permit condition was not considered available to the District because there is no infrastructure in place to use this water. To date, the District has been able to meet its water demands with diversions directly from the Lake Kemp/Diversion System. With projected reduced yields, the WCWID #2 may need to utilize this right.

The recommended strategies to meet the projected shortages associated with the Lake Kemp and Diversion system are to increase Lake Kemp's conservation pool elevation, develop the necessary infrastructure to utilize water directly from the Wichita River, and make the necessary improvements in the WCWID #2 conveyance system to substantially reduce water losses in the system laterals. It is also recommended that Lake Kemp continues to operate with a seasonal pool until the reallocation is finalized. Discussions of these strategies are presented below.

Lake Kemp Reallocation Strategy

One of the management strategies considered for Region B to meet the combined steam electric power and irrigation shortage of 39,774 acre-feet per year, is to increase the conservation storage capacity of Lake Kemp by raising the conservation elevation of the lake. Since 1953, sediment from the Wichita River has created a delta extending into the lake. When the lake is below the conservation pool of 1,144 ft, the delta causes two large areas of the lake to become disconnected from the main part of the lake and the diversion points as shown on Figure 4-4. This essentially limits the usability of the water in storage in the upper part of the lake.

Figure 4-4 Lake Kemp Surface Area



Continued sediment accumulation in the lake has a tremendous impact on the safe supply from the Lake Kemp/ Diversion system as the delta encroaches into the main part of the lake. Raising the conservation pool above the 1144 MSL elevation will reconnect the upper part of the lake with the deeper pool near the dam. To assess the potential increases in yield with reallocation, several conservation elevations were evaluated using the TWDB Red River WAM. Year 2060 sediment conditions and associated yields were assessed based on the proposed conservation elevation increasing in 2020. Table 4-12 shows the findings of this analysis.

Table 4-12
Yield Analyses for Lake Kemp Pool Elevations in Year 2060

Pool Elevation (MSL)	Reservoir Capacity (Ac-Ft)	Firm yield (Ac-Ft/Yr)	Safe Yield (Ac-Ft/Yr)
1144	145,330	78,400	44,800
1148	231,013	103,200	62,900
1150	268,713	111,100	69,400
1152	309,103	120,800	76,000
1156	398,473	123,400	90,700

Currently, the Lake Kemp conservation elevation is set at 1144 MSL. If the conservation elevation was increased to elevation 1148 MSL, the safe supply would increase by 18,100 acre-feet per year in 2060. Additional increases in the conservation elevation shows an additional safe yield of approximately 3,300 acre-feet per year per foot of elevation increase.

This analysis evaluated only the impact on reservoir yields. It did not assess the potential impacts on flood storage or downstream flows. Lake Kemp is permitted to store 318,000 acre-feet of water. Assuming continued sediment accumulation at the rate of 0.90 acre-feet per year per square mile of drainage area, pool raises above 1150 ft. MSL will likely need a water right amendment to store additional water (note: the exact elevation that triggers an increase in permitted storage would be determined during the reallocation study). Therefore, it is recommended that the conservation pool at Lake Kemp be raised to elevation 1150 ft. MSL. As an alternate strategy, the pool could be permanently raised to 1148 ft. MSL and operated with a seasonal pool increase of 1.5 feet from April to October (seasonal increase to 1149.5 ft. MSL). Previous studies have indicated that the seasonal pool at these elevations results in an approximate 5,000 acre-feet of additional yield. A summary of the proposed elevation changes and the impact to reservoir yield is shown on Table 4-13.

Table 4-13
Summary of Lake Kemp Conservation Elevation Increases and Safe Supply
-Values are in Ac-Ft/Yr-

	2010	2020	2030	2040	2050	2060
Recommended Strategy						
Lake Kemp (current conservation elevation at 1144 ft.)	62,383	58,866	55,349	51,832	48,315	44,800
Lake Kemp (conservation elevation increases to 1150 ft)	-	83,700	80,125	76,550	72,975	69,400
Increase in supply	**0**	**24,834**	**24,776**	**24,718**	**24,660**	**24,600**
Alternate Strategy						
Lake Kemp with permanent increase to 1148 ft	-	76,900	73,400	69,900	66,400	62,900
Seasonal Pool (1.5 ft above 1148 ft from April to October) - 1149.5 ft	-	5,000	5,000	5,000	5,000	5,000
Increase in Supply	**0**	**23,034**	**23,051**	**23,068**	**23,085**	**23,100**

It should be understood that any changes in Lake Kemp operations must be approved by the U.S. Army Corps of Engineers. However, if the recommended or alternate scenario was approved, Lake Kemp would yield an additional supply of 23,000 to 25,000 acre-feet per year. These supplies are allocated to users of the Lake Kemp/Diversion system as shown in Table 4-14. It is anticipated that the reallocation would take effect after 2010 and before 2020. Due to the timing of this strategy, irrigation users in Archer, Clay, and Wichita Counties will have unmet needs in 2010.

Table 4-14
Allocation of Supply from Lake Kemp Reallocation
-Values are in Ac-Ft/Yr-

Water User Group	**2020**	**2030**	**2040**	**2050**	**2060**
Archer Irrigation	1,344	1,386	1,426	1,465	1,584
Clay Irrigation	331	309	284	253	274
Wichita Irrigation	15,995	11,186	10,392	9,605	8,687
Wichita Falls	3,364	3,366	3,358	3,350	3,340
Wilbarger Power	3,800	8,529	9,258	9,987	10,715
TOTAL	**24,834**	**24,776**	**24,718**	**24,660**	**24,600**

Lateral Conversion Strategy

Wichita County Water Improvement District No. 2 (WCWID #2) currently maintains and operates approximately 192 miles of irrigation laterals within Archer, Clay, and Wichita Counties. Based on the recently completed Water Conservation Implementation Plan (Attachment 4-4), it was estimated that approximately 13,034 acre-feet of irrigation water is lost annually in ten of the "high loss" laterals due to operational constraints and seepage losses from the unlined open laterals. It is anticipated that this water could be saved by enclosing approximately 15.4 miles of the laterals in pipe. The study showed that pipes ranging from 15 inch to 30 inch diameter would be required, depending upon the design capacity of each lateral. Additional laterals could be evaluated utilizing the same procedure that was applied in the Water Conservation Implementation Plan to identify additional savings while increasing the total length of lateral converted to pipe. Since the "high loss" laterals were initially included in the Conservation Implementation Plan it is expected that the projected conservation volume for conversion of additional laterals to pipe would be lower, thereby increasing the unit conservation cost (dollars per acre-foot).

In summary, in order to provide the additional 39,774 acre-feet per your of steam electric power and irrigation water through the year 2060, the Lake Kemp conservation level must be raised in addition to enclosing in pipe approximately 15.4 miles of irrigation conveyance laterals within the WCWID #2.

Quantity, Reliability, and Cost

As shown in the detailed estimates provided in Attachment 4-2, the capital costs for Lake Kemp improvements are $130,000 with an annual cost of $11,500 and annual cost of water delivered per acre-foot of $0.50.

Cost estimates for the canal system improvements as presented in Attachment 4-4, show that the capital costs are $7,658,000 with an annual cost of $674,377 and annual cost of water delivered per acre-foot of $51.74

Environmental Impacts

There are no known adverse environmental impacts relating to either the Lake Kemp improvements or the canal system improvements. (See Attachment 4-1).

Impacts on Water Resources and Water Management Strategies

Lake Kemp improvements will increase the available yield of the lake and enclosing the canals in pipe will conserve a large amount of irrigation water previously lost.

Impact on Agriculture and Natural Resources

Increasing the yield of Lake Kemp for irrigation purposes will benefit the agriculture lands along with providing the required additional water needed for steam electric power.

Other Relevant Factors

There are no other known relevant factors.

Wichita River Diversion

Certificate of Adjudication 02-5123 provides for the WCWID #2 to divert up to 16,660 acre-feet per year of the authorized 120,000 acre-feet per year of water for irrigation purposes directly from the Wichita River for use within the District's boundaries. The water right specifies two locations on the Wichita River for this diversion, at a combined rate not to exceed 18,000 gpm. To date the District has not needed to use this right and has not constructed permanent infrastructure. It is recommended that the WCWID #2 construct a diversion structure and pump station at one of the two locations to pump water directly from the Wichita River to the irrigation canal system. This water would be in addition to releases from Lake Diversion.

Quantity, Reliability, and Cost

The estimated reliable supply from this right using the Red River WAM is 8,850 acre-feet per year. The actual amount would be contingent on the diversion rate (the WAM is a monthly model and does not account for daily flows or infrastructure limitations). The reliability is moderate because this strategy has limited storage and depends on flows in the river. The capital costs for infrastructure improvements are $5,380,000 with an annual cost of $644,000 and annual cost of water delivered per acre-foot of $73.

Environmental Impacts

The additional use from the Wichita River may decrease stream flows in the river immediately downstream of the diversion. Return flows from the irrigation canals return water to the Wichita River and minimize impacts further downstream.

Impacts on Water Resources and Water Management Strategies

This strategy does not impact other strategies. It may reduce some demands on the Lake Kemp/Diversion system.

Impact on Agriculture and Natural Resources

Increasing the supplies for irrigation purposes will benefit the agriculture lands.

Other Relevant Factors

There are no other known relevant factors.

4.2.6 Mining Water Strategies

Essentially, the only mining activity in Region B is the oil and gas industry. Water is used to drill new wells or in some cases used to water flood selected wells or well fields. Water for mining uses accounts for less than 1.0% of the total water used in Region B.

Montague County Mining

Based on Table 4-2 Montague County is projected to have a mining water shortage of 177 acre-feet per year, by the year 2010. Two potentially feasible strategies were considered to meet the mining need.

One option would be to develop additional groundwater supplies in the county. To meet the required demand utilizing groundwater it is anticipated that one well would need to be drilled in addition to installing 10,000 LF of 6-inch transmission line.

A second option would be to provide for the additional supply from an existing local provider. Depending on the demand location, the local provider would be one of the current water user groups within Montague County or a smaller provider included in the County-Other category. For planning purposes it was assumed that as a minimum the local providers system would require an upgrade of approximately 10,000 LF of 6 inch line in addition to the costs of purchasing the additional required volume of treated water.

Quantity, Reliability, and Cost

A firm supply of 177 acre-feet per year can be provided by developing a groundwater supply well or by purchasing additional water from an existing local provider.

It is anticipated that the supply reliability from the local provider might be better than the groundwater supply since water levels tend to decline over time.

As shown in the detailed cost estimate provided in Attachment 4-2, the capital cost for the additional groundwater supply is $654,000 with an annual cost of $79,025 and an annual cost of water delivered per acre-foot of $447.

In comparison, the capital cost for additional water from a local provider is $412,000 with an annual cost of $241,000 and an annual cost of water delivered per acre-foot of $1,362

Environmental Impacts

Environmental impacts would be minimal for both strategies, assuming that the pipeline could be installed generally along public roads. There could likely be some creek crossings along the route, however, there are no major issues with either strategy that are readily apparent. (See Attachment 4-1).

Impacts on Water Resources and Water Management Strategies

With regards to developing an additional groundwater supply there would be a low impact on the existing water resources and no impact on other water management strategies.

The impacts to other resources and strategies with regards to additional water from a local provider would be indirect. In order for the local providers to provide the required water for mining purposes, the local provider must first have the water to sell. That may require the local provider to purchase additional water from an entity like the City of Bowie or City of Nocona prior to entering into a contract to meet the additional water demand.

Impacts on Agricultural and Natural Resources

In developing a groundwater supply well there is a potential that a small portion of agricultural land could be impacted. However, we believe the impact would be minimal.

With the local provider strategy and the only anticipated construction being the water line improvements along public roads, only minimal agricultural and natural resource impacts are anticipated.

Other Relevant Factors

No other relevant factors regarding either strategy have been identified at this time.

4.2.7 Regional Water Strategy

Chloride Control Project

The concentration of dissolved salts, particularly chloride, in some surface waters in Region B limits the use of these waters for municipal, industrial, and agricultural purposes. The Red River Authority of Texas is the local sponsor and has been working in cooperation with the U.S. Army Corps of Engineers (USACE) for a number of years on a project to reduce the chloride concentration of waters in the Red River Basin. The successful completion of this project would result in an increase in the volume of water available for municipal and industrial purposes in Region B and water would be available for a broader range of agricultural activities. Therefore, the Chloride Control Project (CCP) is included in the Regional Water Plan as one of the feasible strategies for meeting the water supply needed in Region B. Following is a summary of the CCP that presents the background of the project, the components, and current status of the project, and an analysis of the CCP as a regional water resource strategy.

Background

In 1957 the U.S. Public Health Service initiated a study to locate the natural sources that contribute high concentrations of chloride to surface waters in the Red River Basin. It was determined that ten natural salt source areas in the basin contributed approximately 3,300 tons of chloride each day to the Red River.

In 1959 the USACE performed a study to identify control measures for these salt sources. Subsequently, structural measures were recommended for eight source areas.

Description of the Chloride Control Project

The primary strategy for reducing the flow of highly saline waters to the Red River is to impound these flows behind low flow dams and pump the saline waters to off-channel brine reservoirs where the water evaporates or is disposed of by deep-well injection. During high-flow periods, when the chloride concentration is lower, waters flow over the low dams and proceed downstream. Figure 5 identifies the locations of the eight saline inflow areas, the existing and proposed low-flow dams, and the existing and proposed brine reservoirs.

There are four saline inflow areas that impact water quality in Region B:

- Areas VII, VIII, and X affect the quality of water in the Wichita River including Lake Kemp and Lake Diversion.

- Area IX affects the quality of waters in the Pease River, including the proposed Pease River Reservoir.

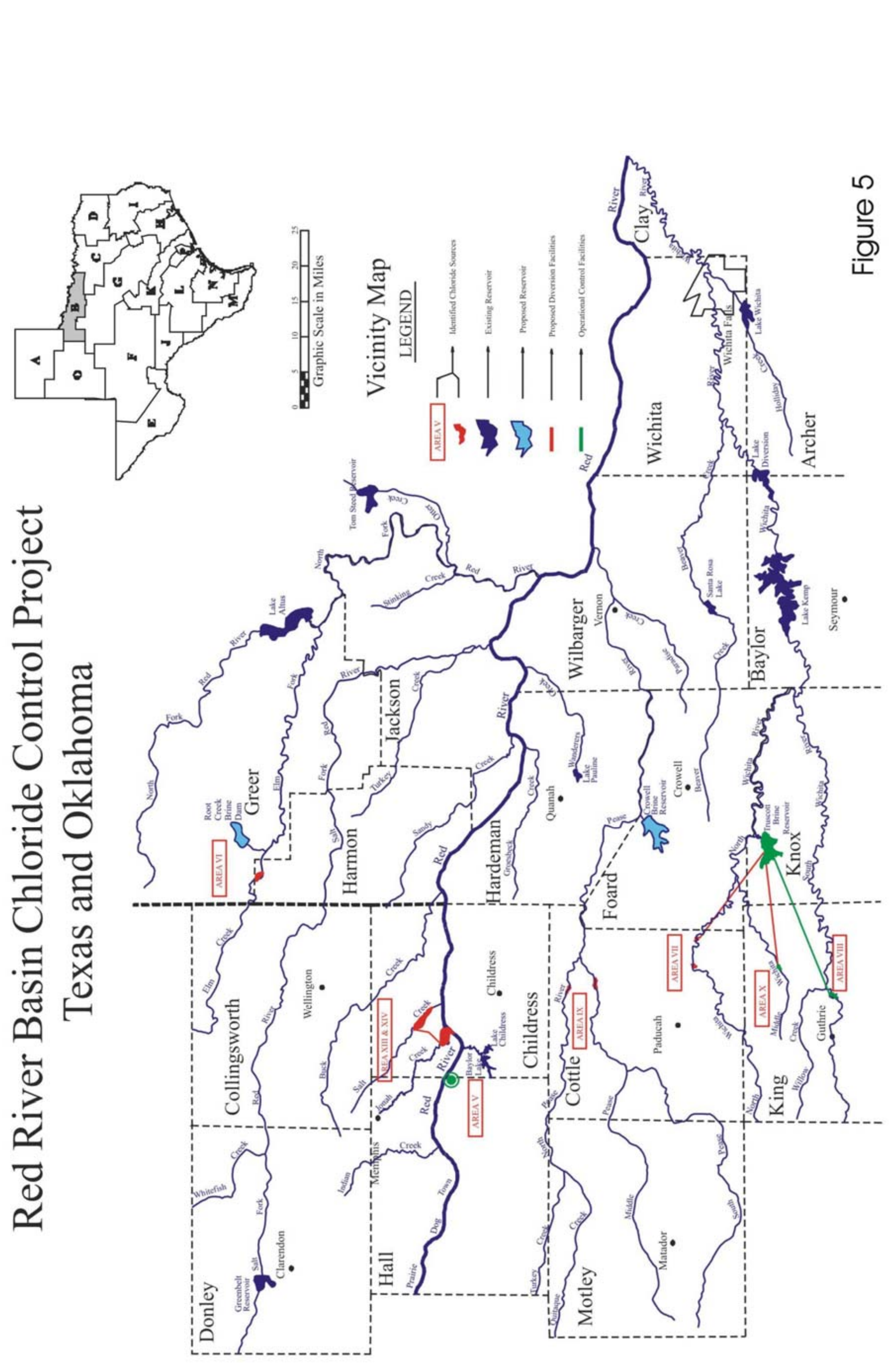
Construction of the chloride control facilities at Area VIII on the South Fork of the Wichita River in King County and Knox County was authorized in 1974. These facilities include a low flow dam near Guthrie, Texas, with a deflatable weir to collect the saline inflows; the Truscott Brine Reservoir near Truscott, Texas; and, a pump station and pipeline to transport the saline water from the impoundment at Guthrie to the Truscott Brine Reservoir. These facilities have been in operation since May 1987. Construction of the facilities at Area X was initiated in 1991, but they have not been completed due to a decision to modify the design of these facilities, a change to the brine disposal area, and a need to address environmental issues identified by the U.S. Fish and Wildlife Service (USFWS) and the Texas Parks and Wildlife Department (TPWD). A Final Environmental Statement (FES) was prepared for the project and published in 1977. A supplement to the FES (SFES) and an Economic evaluation of the project were completed for the Wichita Basin in 2003. These studies found that the Wichita Basin CCP is economically and environmentally feasible and the Record of Decision was signed in March 2004. Construction of the facilities for Areas X and VII are waiting for budget approval.

The effectiveness and environmental impacts of the project will be evaluated as the CCP facilities are completed and operating within the Wichita River Basin. The results of this effort will be used to determine if and, if so, how CCP facilities will be provided for Area IX on the Pease River. The potential Pease River Reservoir would not be viable for a municipal water supply without completion of the CCP for the Pease River Basin.

Analysis of Strategy

Because of the improved water quality resulting from implementation of the CCP, it has been identified as a feasible supply alternative for Region B. Following is an evaluation of the quantity and quality of water that would be provided; the reliability of the supply; the cost to distribute, treat, or convey the water; potential impacts on the environment and agriculture in the area; the regulatory and political acceptability of, and public support for, the project; and the extent to which this strategy could affect other strategies.

This is not a stand-alone alternative. Rather, it is a variation of the other alternatives that include the use of Lake Kemp/Diversion waters. The CCP is a component of a regional alternative in which treatment to remove salts for municipal water use is significantly reduced or replaced by source control for the salt being introduced to the Lake Kemp/Diversion systems.



Red River Basin Chloride Control Project
Texas and Oklahoma
Graphic Scale in Miles
0
5
10
15
20
25
Vicinity Map
LEGEND
AREA V
Identified Chloride Sources
Existing Reservoir
Proposed Reservoir
Proposed Diversion Facilities
Operational Control Facilities
Donley
Collingsworth
Hall
Childress
Cottle
Motley
Foard
King
Knox
Hardeman
Harmon
Greer
Jackson
Wilbarger
Wichita
Baylor
Archer
Clay
Clarendon
Wellington
Memphis
Childress
Paducah
Matador
Guthrie
Quanah
Crowell
Vernon
Seymour
Wichita Falls
Greenbelt Reservoir
Lake Childress
Baylor Lake
Lake Pauline
Crowell Brine Reservoir
Truscott Brine Reservoir
Root Creek Brine Dam
Lake Altus
Tom Steed Reservoir
Santa Rosa Lake
Lake Kemp
Lake Diversion
Lake Wichita
AREA VI
AREA XIII & XIV
AREA V
AREA IX
AREA VII
AREA X
AREA VIII
Red River

Figure 5

With implementation of the CCP, concentrations will change over time. The lowest concentrations anticipated will not require additional treatment 50% of the time although, the highest concentrations would still require some form of treatment or blending to reduce the salt content to meet state standards. However, the highest expected concentration of approximately 489 milligrams per liter would be a vast reduction from the pre-project concentrations of approximately 1.985 milligrams per liter.

However, the benefits of this alternative are not restricted solely to the elimination of the cost of membrane treatment. Also, it minimizes or eliminates the problems and potential adverse environmental impacts of disposal of the brine waste stream from membrane treatment, provides regional economic benefits to the agricultural and industrial sectors of the economy, and extends water supplies for steam electric power generation. These benefits are discussed in more detail later in this section.

<u>Quantity, Reliability, and Cost</u>

The Wichita Basin phase of the CCP that is currently being implemented will increase water resources in the Wichita River Basin and is addressed in this initial regional plan. When the scheduling for the Pease River Basin phase of the project is more certain, the regional plan should be amended to include an evaluation of the effects of the Pease River phase of the project on water resources in Region B.

The water supply source that will be enhanced by the Wichita Basin CCP is the Lake Kemp/Diversion system. As previously described in Chapter 3 of the Region B Water Plan, the firm yield of this system is estimated at 100,650 acre-feet per year in 2000, 80,184 acre-feet per year in 2020, and 39,250 acre-feet per year in 2060. The yield decrease, which is attributable to sedimentation, is expected to be mitigated through an increase in the water conservation elevation and use of a seasonal pool during the irrigation months. Benefits of the CCP would be applicable to all waters stored in the Lake Kemp/Diversion system.

Waters from the Lake Kemp/Diversion system can be used for municipal purposes and agricultural irrigation pursuant to existing water rights. By contract, waters from the system can be used for steam generation of electricity and mining purposes. The waters are also used for recreation.

The total volume of water permitted for use from Lake Kemp/Diversion, and which can be provided in most non-drought years, is 193,000 acre-feet per year.

A significant barrier to the further use of Lake Kemp/Diversion water is the quality of the water. The water quality improvement that would occur as a result of the CCP would make this water suitable for a wider variety of uses, including municipal use that does not require membrane treatment, and more diverse agricultural use. Lower TDS concentrations can also reduce the amount of water needed for irrigation of existing lands and crops through increased efficiencies, and water needed for cooling for industrial purposes.

The CCP strategy alternative has been evaluated to determine yield and cost using the methods specified by the TWDB for the regional planning process. Significant features of these evaluation methods, as they apply to the CCP, are as follows:

- The yield is based on the amount of water available during critical drought conditions.
- The storage volume of the reservoirs will decrease over time as a result of sedimentation.
- The volume of water being used by existing irrigators is expected to decrease over time as a result of the use of water conservation measures. However, as the quality improves, the quantity utilized for irrigation of additional acreage within the existing irrigation district may increase.

It was also assumed that the full benefit of the CCP may not be realized until 20 years after implementation, in accordance with the FES for the CCP, which was prepared in 1976.

The FES projected that the salt content in Lake Kemp would decrease over time after project completion. The projected concentrations that would not be exceeded 98 percent of the time are as follows:

Time	Chloride mg/L	Sulfate mg/L	TDS mg/L
Pre-project	1,312	755	3,254
Twenty years after implementation	318	395	1,108

These estimates are based on the assumption that the CCP will control 83 percent of the chloride load from Areas VII, VIII, and X.

Studies by the U.S. Geological Survey and others have evaluated the effectiveness of the Area VIII control structure (which was completed in 1987). These studies confirm that the Area VIII CCP removes approximately 80 percent of the chloride load introduced by Area VIII sources. Accordingly, the average chloride concentration in Lake Kemp has decreased to approximately 1,000 milligrams per liter (mg/L). Since current studies tend to confirm the general reliability of the 1976 projections regarding the effectiveness of salt removal, it appears that within 20 years after the completion of the CCP for Areas X and VII, it may no longer be necessary to remove chlorides from waters withdrawn from Lake Kemp/Diversion for municipal supply by demineralization.

Potentially more water will be available for municipal use as a result of the CCP. At the present time, small amounts of water from Lake Kemp/Diversion are used to extend other available supplies. Wichita Falls currently uses water from Lake Kemp by utilizing membrane treatment. As the CCP improves water quality, the efficiency of the treatment system will increase and the amount of water lost as reject water will be reduced.

The yield of additional water from the CCP is difficult to estimate because its primary purpose is to improve water quality, which increases the usability of the water. Considering improved efficiencies for municipal, industrial, and irrigation uses, it is estimated that the CCP could produce up to 30 percent of water savings of current use. This is attributed to reduced losses with municipal treatment and improved water transport in soils for irrigation. By 2020, these savings are estimated to be 26,500 acre-feet per year.

As shown in the detailed cost estimates in Attachment 4-2, the capital costs for the CCP is $95,450,000 with an annual cost of $7,572,425 and a cost of water delivered per acre-foot of $286. NOTE: Remaining cost to completion is $50,032,000 and remaining annual cost is $4,808,900.

It should also be noted that the cost impacts of the CCP on residents of Region B and the State of Texas are different than the cost impacts of membrane treatment or other supply strategies. The capital costs of the CCP facilities will be funded with federal monies. The full capital costs of membrane treatment will be funded by local users.

In addition, there are other economic benefits to the region and further value added to the water resources of the region because the quality improvement associated with the CCP will result in more efficient utilization of water. Improvement of the quality of the water will make it feasible for irrigators to grow a wider range of crops. At the present time, only crops with a high salt tolerance can be irrigated with water from Lake Kemp/Diversion. Being able to irrigate a wider range of crops can allow the irrigators to grow crops of higher value.

The CCP will also provide benefits to the industrial sector of the economy and have a positive effect on water supplies for steam power generation because it will reduce the water demand. The concentration of TDS in a water supply limits the number of times the water can be cycled through the cooling system. If the TDS concentration is decreased, the number of cooling cycles can be increased. Subsequently, the blow-down volume will decrease, reducing disposal costs.

The water supply produced by the CCP would be of high reliability. However, the ability of the Lake Kemp/Diversion system to deliver the full volume of water authorized by existing water rights during drought conditions is questionable because the sum of authorized water rights for all uses exceeds the firm yield of the Lake Kemp/Diversion system. Therefore, in times of drought, appropriate adjustments may be required if all users wish to take their fully authorized amount. However, a significant volume of water will be reliably available for each of the authorized uses if the CCP is implemented.

This alternative provides an additional quantity of water that has a quality suitable for a wide variety of municipal, industrial, agricultural, and steam electric purposes. The resultant water supply is projected to achieve the EPA secondary criteria for drinking water 94 to 98 percent of the time.

Environmental Factors

As previously noted, several environmental impact studies have been completed and the conclusion of these studies is that the CCP is an environmentally feasible project.

Monitoring to evaluate the environmental issues that have been previously raised will continue after construction of the remaining CCP facilities in the Wichita River Basin. If no significant adverse impacts attributable to the CCP are identified, consideration will be given to proceeding with the Pease River Basin CCP facilities.

The environmental issues that have been identified are summarized below:

- Selenium (Se) is a naturally occurring element in soils in the western United States and in the waters of the CCP project area. Se in trace amounts is an essential dietary component. However, it has been concluded that, in higher concentrations in water and sediment, Se adversely impacts aquatic birds in some areas of the country. Concern has been expressed that the concentration of Se in the brine disposal reservoirs will increase due to evaporation and pose a threat to local and migratory birds, fish, and wildlife. Data collected at the Truscott Brine Reservoir have found no increases in Selenium concentrations following 11 years of operation and Selenium is not expected to result in excessive risk at the Brine Lake.

- Small decreases in flows are projected to occur in the Wichita River and the Red River between the Wichita River confluence and Lake Texoma. These flow decreases will result from the diversion of low flows to the brine disposal reservoirs and increased use of the river flow for irrigation when the quality improves. Changes in water quality and quantity could impact the composition of vegetation along these river reaches and result in vegetative encroachment on the stream channel. There is a concern that decreased flows and changes in vegetative composition could adversely affect the habitat for aquatic life, birds, and wildlife. These changes are expected to be low to moderate and potential impacts are addressed in the monitoring and mitigation plan for the project.

- There is a concern that wetlands in the Red River flood plain will be adversely impacted as a result of both changes in the hydrologic regime and the conversion of land adjacent to the river to cropland and pasture. These potential impacts are also addressed in the monitoring and mitigation plan for the CCP.

- Concern has been expressed that the reduction in the TDS concentration in Lake Texoma, associated changes in physical characteristics of the lake (turbidity), a decrease in primary production rates due to a decrease in the depth of the eutrophic zone, and alterations in nutrient cycling will reduce the sport fish harvest in the lake, and may affect the aesthetic quality of the lake. Studies have shown that the changes in TDS concentration in Lake Texoma associated with the Wichita River CCP are expected to have negligible adverse impacts to fisheries or aesthetics to the lake.

Each of these issues was addressed in the SFEIS, and the report concludes there will not be significant impacts in most cases. Where potential impacts have been identified, mitigation and monitoring measures are proposed.

Several state and federally listed threatened and endangered species are present in, or migrate through, the project area. To address concerns related to the bald eagle, whooping crane, and least tern, in 1994 the USFWS and USACE agreed upon a Biological Opinion that defines Reasonable and Prudent Measures to protect these species. These measures are described in Supplement I to the SFES.

Impacts on Water Resources and Other Water Management Strategies

Other strategies considered for the Lake Kemp/Diversion include increasing the conservation pool elevation and enclosing canal laterals in pipe. Each of these strategies will increase the available supply from the Lake Kemp/Diversion system. Successful implementation of the CCP will ultimately improve the water quality in the lake, which will reduce treatment costs and improve efficiencies for users that utilize Lake Kemp/Diversion. For Wichita Falls that will be using water from Lake Diversion as a municipal water source, the CCP will 1) reduce the amount of treatment needed to produce high quality drinking water; and, 2) increase the ratio of produced water to raw water. For industrial and irrigation water users, the CCP will allow more efficient use of the water supply, providing a positive impact to the other strategies identified for Lake Kemp/Diversion water users.

Impacts on Agriculture and Natural Resources

The impacts on agriculture associated with the CCP are positive. The improvements in the quality of water will allow the water to be used to irrigate a wider variety of crops and reduce the potential for salt build-up in soils.

Other Relevant Factors

The CCP is waiting for funding appropriations through the Corps of Engineers.

The political acceptability of the project varies depending on the sector of the community. Municipalities, industries, and the agricultural community are supportive of the project. The degree of support for the project is evidenced by the congressional approval and funding of the project in bills enacted in 1962, 1966, 1970, 1974, 1976, and 1986. In 1988, a special panel created by the Water Resource Development Act of 1986 issued a report favorable to the project. The natural resource agencies, Lake Texoma sport fishermen, and related lake businesses have expressed opposition to the project. However, substantial progress has been made in addressing the natural resource and fishing concerns.

4.3 Selection of Preferred Water Management Strategies by County

Based on a comparison of the total regional water supply to demand as shown in Table 4-1, it was determined that there is adequate water supply to meet the needs of Region B as a whole up to the year of 2019. However, by the year 2020, the region is projected to have a supply shortage of 716 acre-feet per year and by 2060 the shortage will increase to 16,112 acre-feet per year.

In addition, based on a comparison of the supply to demand of each water user group in Region B, the various water needs were identified and water management strategies were evaluated as documented in this chapter. Though all the strategies may be viable options and should be considered by each affected entity, the following is a listing by county of the preferred water management strategies for each water user group with projected water supply needs.

4.3.1 Archer County

The maximum projected water need for Archer County is 1,892 acre-feet per year. Most of this need (1,584 acre-feet per year) is associated with the irrigation supply shortage from Lake Kemp.

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
Archer Co. (other)	Municipal Conservation	18 [1.]	$1.72	2010
	Purchase water from Local Provider	296	$5.37	2010
Lakeside City	Municipal Conservation	11 [1.]	$1.39	2010
	Purchase water from Wichita Falls	12	$3.25	2010
Archer Co. Irrigation	Increase water conservation elevation at Lake Kemp	1,584 [1.]	$0.01	2020
TOTAL		1,921		
ALTERNATE STRATEGIES – NONE IDENTIFIED				

1. Supply varies by decade. The amount shown is the supply from this strategy in year 2060.

4.3.2 Baylor County

There is a safe supply water shortage in Baylor County of Region B, for Baylor WSC and an interconnect to Millers Creek Reservoir is recommended.

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
Baylor WSC	Interconnect to Millers Creek Reservoir	250	$3.84	2010

4.3.3 Clay County

The maximum projected water need for Clay County is 582 acre-feet per year. Most of this need (349 acre-feet per year) is associated with the irrigation supply shortage from Lake Kemp.

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
Clay Co. (other)	Municipal Conservation	39 [1.]	$0.78	2010
	Purchase water from Local Provider	223	$4.48	2010
Clay Co. Irrigation	Increase water conservation elevation at Lake Kemp	274 [1.]	$0.01	2020
Charlie WSC	Nitrate Removal Plant	10	$7.83	2010
TOTAL		546		
ALTERNATE STRATEGIES – NONE IDENTIFIED				

1. Supply varies by decade. The amount shown is the supply from this strategy in year 2060.

4.3.4 Cottle County

There are no projected water shortages in Cottle County of Region B.

4.3.5 Foard County

There are no projected water shortages in Foard County of Region B.

4.3.6 Hardeman County

There are no projected water shortages in Hardeman County of Region B.

4.3.7 King County

There are no projected water shortages in King County of Region B.

4.3.8 Montague County

The maximum projected water need for Montague County is 932 acre-feet per year. Most of this need (584 acre-feet per year) is associated with a safe need for Montague County (other).

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
Montague Co. (other)	Develop Additional Groundwater Supplies	584	$1.88	2010
City of Bowie	Municipal Conservation	72 [1.]	$0.71	2010
	Wastewater Reuse	171	$2.92	2040
Montague Co. (Mining)	Purchase Water from Local Provider	177	$4.18	2010
TOTAL		1,004		
ALTERNATE STRATEGIES				
Montague Co. (other)	Purchase water from Local Provider	584	$3.68	2010
City of Bowie	Develop Additional Groundwater Supply	171	$3.68	2040
Montague Co. (Mining)	Develop Additional Groundwater Supply	177	$1.37	2010

1. Supply varies by decade. The amount shown is the supply from this strategy in year 2060.

4.3.9 Wichita County

The maximum projected water need for Wichita County is 31,633 acre-feet per year. Most of this need (27,201 acre-feet per year) is associated with the irrigation supply shortage from Lake Kemp.

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
City of Iowa Park	Municipal Conservation	80 [1.]	$0.83	2010
	Purchase Water from Wichita Falls	229	$3.25	2010
City of Wichita Falls	Municipal Conservation	1,367 [1.]	$0.24	2010
	Increase water conservation elevation at Lake Kemp	3,340	$0.01	2020
	Construction Lake Ringgold	27,000	$4.32	2050
Wichita Co. Irrigation	Increase water conservation elevation at Lake Kemp	8,687 [1.]	$0.01	2020
	Wichita River Diversion	8,850	$0.22	2040
	Enclose Canal Laterals in Pipe	13,034	$0.16	2010
Wichita County Manufacturing	Purchase Water from Wichita Falls	462	$3.25	2010
TOTAL		63,049		
ALTERNATE STRATEGIES				
City of Wichita Falls	Wastewater Reuse	11,000	$2.36	2050

1. Supply varies by decade. The amount shown is the supply from this strategy in year 2060.

4.3.10 Wilbarger County

The maximum projected water need for Wilbarger County is 10,864 acre-feet per year. Most of this need (10,715 acre-feet per year) is associated with the steam-electric power supply shortage from Lake Kemp.

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
Lockett Water System	Purchase water from City of Vernon	109	$6.96	2010
Hinds-Wildcat System	Nitrate Removal Plant	40	$4.18	2010
Wilbarger Co. Steam Electric Power	Increase Water Conservation elevation at Lake Kemp	10,715 [1.]	$0.01	2020
TOTAL		10,864		
ALTERNATE STRATEGIES				
Hinds-Wildcat System	Purchase water from City of Vernon	40	$9.36	2010

1. Supply varies by decade. The amount shown is the supply from this strategy in year 2060.

4.3.11 Young County

There are no projected water shortages in Young County of Region B.

4.3.12 Regional Strategies

The Chloride Control Project in the Wichita River Basin is a recommended regional strategy for Region B. This project will provide water savings through increased efficiencies in municipal water treatment and irrigation use due to improved water quality.

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
Regional	Wichita Basin Chloride Control Project	26,500	$0.88	2010

LIST OF REFERENCES

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ATTACHMENT 4-1

REGIONAL WATER PLANNING GROUP B

STRATEGY EVALUATION MATRIX

ATTACHMENT 4-1
STRATEGY EVALUATION MATRIX – REGION B

Water User Group	Strategy Description	Quantity, Reliability, and Cost	Environmental Impacts	Impacts on Water Resources and Other Water Management Strategies	Impacts on Agriculture and Natural Resources	Other Relevant Factors	Overall Rating
Archer Co. (Other)	Purchase water from Local Provider	Adequate Quantity, Good Reliability, Moderate Cost	Low impact from pipeline	Low Impact	Low Impact	None identified	N.A
Baylor WSC	Safe Supply From Millers Creek Res.	Good Quality, Good Reliability, Moderate Cost	Low Impact	Low Impact	Low Impact	Safe Supply	N.A
Clay Co. (Other)	Purchase water from Local Provider	Adequate Quantity, Good Reliability, Moderate Cost	Low impact from pipeline	Low Impact	Low Impact	None identified	N.A
Montague Co. (Other)	Develop Additional Groundwater Supply Score:	Adequate Quantity, Good Reliability, Low Cost 9	Low to moderate impact 8	Low Impact 8	Low to moderate impact 8	None identified 9	51
	Purchase water from Local Provider Score:	Adequate Quantity, Good Reliability, Moderate Cost 7	Low Impact 9	Low Impact 8	Low Impact 9	None identified 9	49
City of Bowie	Develop Groundwater Supplies Score:	Adequate Quantity, Good Reliability, Moderate Cost 7	Low to moderate impact 8	Low to moderate impact 8	Low to moderate impact 8	Mix surface water with groundwater 8	46
	Wastewater Reuse Score:	Adequate Quantity, Good Reliability, Low Cost 9	Low to moderate impact 8	Low impact 9	Low impact 9	Public perceptions 7	51
City of Iowa Park	Purchase additional water from Wichita Falls	Good Quantity, Good Reliability, Low Cost	Low impact	Low impact	Low Impact	None identified	N.A
Lakeside City	Purchase additional water from Wichita Falls	Good Quantity, Good Reliability, Low Cost	Low impact	Low impact	Low Impact	None identified	N.A
City of Wichita Falls	Wastewater Reuse Score:	Good Quantity, Good Reliability, Lower Cost 8	Low impact 7	Low to moderate impact 7	Low Impact/Moderate to High 7	Public perceptions 3	40
	Construct Lake Ringgold Score:	Good Quantity, Good Reliability, Higher Cost 9	Moderate impact 6	Decrease flow in Red River 6	Moderate to High impact 5	Permitting and Time Issues 6	41

Score Rating: 1 through 10 with 10 being most favorable rating. Quality, Reliability and Cost weighted by factor of 2.

ATTACHMENT 4-1

STRATEGY EVALUATION MATRIX – REGION B

Water User Group	Strategy Description	Quantity, Reliability, and Cost	Environmental Impacts	Impacts on Water Resources and Other Water Management Strategies	Impacts on Agriculture and Natural Resources	Other Relevant Factors	Overall Rating
Charlie WSC	Nitrate Removal Plant	Adequate Quantity, Good Reliability, Moderate Cost	Low Impact	Low Impact	Low Impact	None identified	N.A
Hinds-Wildcat System	Nitrate Removal Plant Score:	Adequate Quantity, Good Reliability, Moderate Cost 9	Low Impact 9	Low Impact 9	Low Impact 9	None identified 9	54
	Purchase water from Vernon Score:	Adequate Quantity, Good Reliability, High Costs 7	Low Impact 9	Low Impact 9	Low Impact 9	None identified 9	50
Lockett Water System	Purchase water from Vernon	Good Quantity, Good Reliability, High Costs	Low Impact	Low Impact	Low Impact	None identified	N.A
Wilbarger Co. Steam Electric Power	Increase Water Conservation elevation at Lake Kemp Score:	Good Quantity, Good Reliability, Low Cost 10	Low Impact 9	Low Impact 9	Low Impact 9	None identified 9	56
	Enclose canal Laterals in pipe Score:	Good Quantity, Good Reliability, Moderate Cost 8	Low Impact 9	Low Impact 9	Low Impact 9	None identified 9	52
Archer Co. Irrigation	Increase Water Conservation elevation at Lake Kemp Score:	Good Quantity, Good Reliability, Low Cost 10	Low Impact 9	Low Impact 9	Low Impact 9	None identified 9	56

Score Rating: 1 through 10 with 10 being most favorable rating. Quality, Reliability and Cost weighted by factor of 2.

ATTACHMENT 4-1
STRATEGY EVALUATION MATRIX – REGION B

Water User Group	Strategy Description	Quantity, Reliability, and Cost	Environmental Impacts	Impacts on Water Resources and Other Water Management Strategies	Impacts on Agriculture and Natural Resources	Other Relevant Factors	Overall Rating
Clay Co. Irrigation	Increase Water Conservation elevation at Lake Kemp Score:	Good Quantity, Good Reliability, Low Cost 10	Low Impact 9	Low Impact 9	Low Impact 9	None identified 9	56
Wichita Co. Irrigation	Increase Water Conservation elevation at Lake Kemp Score:	Good Quantity, Good Reliability, Low Cost 10	Low Impact 9	Low Impact 9	Low Impact 9	None identified 9	56
	Enclose Canal Laterals in pipe Score:	Good Quantity, Good Reliability, Moderate Cost 8	Low Impact 9	Low Impact 9	Low Impact 9	None identified 9	52
	Wichita River Diversion Score:	Good Quality, Moderate Reliability, Moderate Cost 8	Low to Moderate Impact 8	Low to Moderate 8	Low Impact 9	None Identified 9	50
Montague Co. Mining	Purchase water from Local Provider Score:	Good Quality, Good Reliability, High Costs 8	Low Impact 9	Low Impact 9	Low Impact 9	Typically Short-Term use 9	52
	Develop Groundwater Supply Score:	Good Quality, Good Reliability, Low Cost 9	Low Impact 9	Low Impact 9	Low Impact 8	Typically Short-Term use 7	51
Wichita Co. Manufacturing	Purchase Water from Wichita Falls	Good Quality, Good Reliability, Moderate Cost	Low Impact	Low Impact	Low Impact	None identified	N.A
Water User Group	Strategy Description	Quantity, Reliability, and Cost	Environmental Impacts	Impacts on Water Resources and Other Water Management Strategies	Impacts on Agriculture and Natural Resources	Other Relevant Factors	Overall Rating
Regional	Construct Chloride Control Project	Good Quantity Moderate Costs	Being evaluated by USACE	Should Improve Water Quality Enhance R.O. Treatment	Should Improve Agriculture Lands	Effects not realized for 20 yr.	N.A

Score Rating: 1 through 10 with 10 being most favorable rating. Quality, Reliability and Cost weighted by factor of 2.

Attachment 4-1
Summary of Environmental Assessment – Region B

Water USER Group	Strategy Description	Environmental Factors							
		Total Acres Impacted	**Wetland Acres[1]**	**Environmental Water Needs**	**Habitat**	**Cultural Resources**	**Bays & Estuaries**	**Environmental Water Quality**	**Overall Environmental Impacts**
Name(s)	Name	#	#	(1-10)	(1-10)	(1-10)	(1-10)	(1-10)	(1-10)
Archer Co. (Other)	Purchase Water from Local Provider	5	0	9	9	9	9	9	9
Baylor WSC	Safe Supply from Millers Creek	5	0	9	9	9	9	9	9
Clay Co. (Other)	Purchase Water from Local Provider	5	0	9	9	9	9	9	9
Montague Co. (Other)	Develop Additional Groundwater Supply	20	0						8
	Purchase Water from Local Provider	5	0	9	9	9	9	9	9
City of Bowie	Develop Groundwater Supply	10	0						8
	Wastewater Reuse	3	0						8
City of Iowa Park	Purchase Additional Water from Wichita Falls	0	0	9	9	9	9	9	9
Lakeside City	Pruchase Additional Water from Wichita Falls	0	0	9	9	9	9	9	9
City of Wichita Falls	Wastewater Reuse	25	0	8	8	9	9	9	8
	Construct Lake Ringgold	17,100	1,150	5	2	6	7	7	5
Charlie WSC	Nitrate Removal Plant	10	0	9	9	9	9	9	9
Hinds-Wildcat Water System	Nitrate Removal Plant	10	0	9	9	9	9	9	9
	Purchase Water from Vernon	6	0	9	9	9	9	9	9
Lockett Water System	Purchase Water from Vernon	0	0	9	9	9	9	9	8
Wilbarger Co. Steam Electric Power	Increase Water Conservation Elevation at Lake Kemp			8	9	9	9	9	9
	Enclose Canal Laterals in Pipe	0	0	8	9	9	9	9	9
Archer Co. Irrigation	Increase Water Conservation Elevation at Lake Kemp			8	9	9	9	9	9
Clay Co. Irrigation	Increase Water Conservation Elevation at Lake Kemp			8	9	9	9	9	9
Wichita Co. Irrigation	Increase Water Conservation Elevation at Lake Kemp			8	9	9	9	9	9
	Enclose Canal Laterals in Pipe	0	0	8	9	9	9	9	9
	Wichita River Diversion	0	0	8	9	9	9	9	9
Wichita Co. Manufacturing	Purchase Additional Water from Wichita Falls	0	0	9	9	9	9	9	9
Montague Co. Mining	Purchase Water from Local Provider	0	0	8	9	9	9	9	9
	Develop Groundwater Supply	10	0	8	9	9	9	9	9

[1]Based on National Wetlands Inventory digital data for Riverland Cemetery USGS Quad.

Score Rating: 1 through 10 with 10 being most favorable rating. Quality, Reliability and Cost weighted by factor of 2.

ATTACHMENT 4-2

REGIONAL WATER PLANNING GROUP B

DETAILED COST ESTIMATES

ATTACHMENT 4-2

REGIONAL WATER PLANNING GROUP B

DETAILED COST ESTIMATES

ATTACHMENT 4-2
DETAILED COST ESTIMATES

The following cost estimates were prepared in general compliance with SB1 guidelines and capital costs based on the latest cost estimates for similar type work recently completed within Region B. Both capital costs and annual costs are identified for each strategy in addition to the cost of water delivered per acre-foot and cost of water delivered per 1,000 gallons.

Capital Costs include all conveyance system construction, pipelines, pump stations, storage tanks, treatment facilities, disinfection facilities and all required capital improvement expenditures.

Operations and Maintenance costs includes power costs, chemical costs and annual required maintenance expenditures.

All debt service was calculated over 20 years at a 6 percent interest rate except for the Lake Ringgold and Chloride Control Projects which were calculated over 40 years at a 6 percent interest rate.

Archer County (other)

Assumption: Purchase water from Local Provider
Need: 187 AF/YR (FIRM) 296 AF/YR (SAFE)

Construction Costs:	
6" Water Line Upgrade	$265,000
Other Project Costs:	
Engineering, Contingencies & Legal @ 30%	80,000
Pipeline Easements	11,000
Interest During Const. (6 months)	8,000
Total Capital Costs:	**$364,000**
Annual Costs:	
Debt Service (20 yrs @ 6%)	32,000
Operation & Maint.	3,000
Water Purchases ($5.00/1,000 Gals)	483,000
Total Annual Costs:	**$518,000**
Available Water (AF/YR)	296
Available Water (MGD)	0.26
Cost of Water Delivered ($/A.F.)	**$1,750**
Cost of Water Delivered ($/1,000 Gals)	**$5.37**

Baylor WSC

Assumption: Safe Supply from Millers Creek Reservoir
Need: 0 (Firm) – 250 AF/YR (Safe)

Construction Costs:	
6" Water Line (20,000 LF)	$530,000
Other Project Costs:	
Engineering, Contingencies & Legal @ 30%	159,000
Pipeline Easements	11,000
Interest During Const. (4 months)	14,000
Total Capital Costs:	**$714,000**
Annual Costs:	
Debt Service (20 yrs @ 6%)	63,000
Operation & Maint.	6,000
Water Purchases ($3.00/1,000 Gals)	244,000
Total Annual Costs:	**$313,000**
Available Water (AF/YR)	250
Available Water (MGD)	0.22
Cost of Water Delivered ($/A.F.)	**$1,252**
Cost of Water Delivered ($/1,000 Gals)	**$3.84**

Clay County (Other)

Assumption: Purchase water from Local Provider
Need: 45 AF/YR (FIRM) 223 AF/YR (SAFE)

Construction Costs:	
6" Water Line Upgrade	$265,000
Other Project Costs:	
Engineering, Contingencies & Legal @ 30%	80,000
Pipeline Easements	11,000
Interest During Const. (6 months)	8,000
Total Capital Costs:	**$364,000**
Annual Costs:	
Debt Service (20 yrs @ 6%)	32,000
Operation & Maint.	3,000
Water Purchases ($4.00/1,000 Gals)	291,000
Total Annual Costs:	**$326,000**
Available Water (AF/YR)	223
Available Water (MGD)	0.20
Cost of Water Delivered ($/A.F.)	**$1,462**
Cost of Water Delivered ($/1,000 Gals)	**$4.48**

Montague County (Other) – Option 1

Assumption: Develop Additional Groundwater Supply
Need: 304 AF/YR (FIRM) 584 AF/YR (SAFE)

Construction Costs:	
Water Supply Wells (6 EA)	$750,000
6" Transmission Line	265,000
Pump Sta. & Ground Storage	450,000
Other Project Costs:	
Engineering, Contingencies & Legal @ 30%	439,500
Land & Easements	250,000
Interest During Const. (12 Months)	129,000
Total Capital Costs:	**$2,283,500**
Annual Costs:	
Debt Service: (20 YRS @ 6%)	$199,000
Operation & Maint.	$35,000
Pumping Costs	$125,000
Total Annual Costs:	**$359,000**
Available Water (AF/YR)	584
Available Water (MGD)	0.51
Cost of Water Delivered ($/AF)	**$614**
Cost of Water Delivered ($/1000 Gals)	**$1.88**

Montague County (Other) – Option 2

Assumption: Purchase Water from Local Provider
Need: 304 AF (FIRM) 584 AF/YR (SAFE)

Construction Costs:	
6" Transmission Line	$265,000
Other Project Costs:	
Engineering, Contingencies & Legal @ 30%	79,500
Pipeline Easements	10,000
Interest During Const. (6 months)	10,000
Total Capital Costs:	**$364,500**
Annual Costs:	
Debt Services (20 yrs. @ 6%)	$32,000
Operation & Maint.	2,650
Water Purchases ($3.50/1000 Gals)	666,000
Total Annual Costs	**$700,650**
Available Water (AF/YR)	584
Available Water (MGD)	0.51
Annual Cost of Water Delivered ($/AF)	**$1,200**
Annual Cost of Water Delivered ($/1,000 Gals)	**$3.68**

City of Bowie – Option 1

Assumption: Develop Groundwater Supply
Need: 0 (FIRM) 171 (SAFE)

Construction Costs:	
Water Supply Wells (2 EA)	$300,000
6" Transmission Line	265,000
Pump Sta. & Ground Storage	450,000
Other Project Costs:	
Engineering, Contingencies & Legal @ 30%	305,000
Land & Easements	250,000
Interest During Const. (12 Months)	80,000
Total Capital Costs:	**$1,650,000**
Annual Costs:	
Debt Service (20 yrs @ 6%)	$144,000
Operation & Maintenance	26,000
Pumping Costs	35,000
Total Annual Costs:	**$205,000**
Available Water (AF/YR)	171
Available Water (MGD)	0.50
Cost of Water Delivered ($/AF)	**$1,200**
Cost of Water Delivered ($/1000 Gals)	**$3.68**

City of Bowie – Option 2

Assumption: Wastewater Reuse
Need: 0 (FIRM) 171 (SAFE)

Construction Costs:	
Treatment Facilities	$325,000
Pump Station	350,000
8" Pipeline	200,000
Other Project Costs:	
Engineering, Contingencies & Legal @ 30%	$262,500
Pipeline Easements	10,000
Interest During Const. (12 Months)	69,000
Total Capital Costs:	**$1,206,500**
Annual Costs:	
Debt Service (20 yrs. @ 6%)	105,500
Operation & Maintenance	22,000
Pumping Costs	35,000
Total Annual Costs	**$162,500**
Available Water (AF/YR)	171
Available Water (MGD)	0.15
Cost of Water Delivered ($/AF)	**$950**
Cost of Water Delivered ($/1,000 Gals)	**$2.92**

City of Iowa Park

Assumption: Purchase Additional Water from Wichita Falls
Need: 0 (FIRM) 229 AF/YR (SAFE)

Construction Costs:	**0**
Other Costs:	
Engineering, Contingencies and Legal (30%)	0
Interest During Construction (6 months)	0
Total Capital Costs:	**0**
Annual Costs:	
Debt Service (20 yrs @ 6%)	0
Operation and Maintenance	0
Water Purchases ($3.25/1,000 Gals)	242,500
Total Annual Costs:	**$242,500**
Available Water (AF/YR)	229
Available Water (MGD)	0.20
Cost of Water Delivered ($/AF)	**$1,059**
Cost of Water Delivered ($/1000 Gals)	**$3.25**

City of Lakeside City

Assumption: Purchase Additional Water from Wichita Falls
Need: 0 (FIRM) 12 (SAFE)

Construction Costs:	**0**
Other Project Costs:	**0**
Total Capital Costs:	**0**
Annual Costs:	
Debt Service	0
Operation & Maint.	0
Water Purchase ($3.25/1,000 Gal)	$12,707
Total Annual Costs:	**$12,707**
Available Water (AF/YR)	12
Available Water (MGD)	.01
Cost of Water Delivered ($/AF)	**$1,059**
Cost of Water Delivered ($/1,000 Gals)	**$3.25**

City of Wichita Falls-Option 1

Assumption: Wastewater Reuse
Need: 0 (FIRM) 4,203 (SAFE)

Construction Costs:	
RRWWTP Denitrification Improvements	$7,200,000
Microfiltration Treatment	8,400,000
UV Disinfection	2,400,000
RRWWTP Pump Station	1,800,000
30" Pipeline to Secondary Reservoir (12 miles)	9,500,000
10 MGD Pump Station and Water Treatment	10,500,000
Other Project Costs:	
Engineering, Legal, Financial & Contingencies	$12,000,000
Land and Easements	100,000
Environmental Studies, Mitigation & Permitting	500,000
Interest During Construction (18 Months)	4,700,000
Total Capital Project Costs:	**$57,100,000**
Annual Costs:	
Debt Service (20 yrs @ 6%)	$4,979,000
Operation and Maintenance	600,000
Power Costs (Pumping Facilities)	200,000
Water Treatment Costs ($0.75/1,000 Gal.)	2,688,000
Total Annual Cost:	**$8,467,000**
Available Water (AF/YR)	11,000
Available Water (MGD)	10
Cost of Water Delivered ($/AF)	**$770**
Cost of Water Delivered ($/1000 Gallons)	**$2.36**

City of Wichita Falls-Option 2

Assumption: Construct Lake Ringgold
Need: 0 (FIRM) 4203 (SAFE)

Construction Costs:	
Ringgold Reservoir (275,000 Acre-Feet Capacity)	$85,000,000
Pumping Facilities (2-24.5 MGD)	8,450,000
54" Raw Water Line to Storage, Reservoir (40 miles)	85,000,000
24.5 MGD Pumping Facility @ Storage Reservoir	4,200,000
24.5 MGD Water Treatment Facility	36,750,000
Other Project Costs:	
Engineering, Legal, Financial, & Contingencies	66,000,000
Land and Easements	16,500,000
Environmental Studies, Mitigation & Permitting	16,500,000
Interest During Construction (5 years)	64,500,000
Total Capital Project Cost	**$382,900,000**
Annual Costs:	
Debt Service (Reservoir 40 yrs. @ 6%)	11,637,500
Debt Service (Pipeline/Pump Sta. 30 yrs. @ 6%)	15,977,000
Operation & Maintenance	4,500,000
Power Cost (Pumping Facilities)	1,500,000
Water Treatment Costs ($0.25/1,000 Gal.)	4,400,000
Total Annual Cost	**$38,014,500**
Available Water (AF/YR)	27,000
Available Water (MGD)	24
Cost of Water Delivered ($/AF)	**$1,408**
Cost of Water Delivered ($/1000 Gallons)	**$4.32**

Wichita Co. Manufacturing

Assumption: Purchase Additional Water from Wichita Falls
Need: 0 (FIRM)   462 (SAFE)

Construction Costs:	**0**
Other Project Costs:	**0**
Total Capital Costs:	**0**
Annual Costs:	
Debt Service	0
Operation & Maint.	0
Water Purchase ($3.25/1,000 Gal)	$489,230
Total Annual Costs:	**$489,230**
Available Water (AF/YR)	462
Available Water (MGD)	.40
Cost of Water Delivered ($/AF)	**$1,059**
Cost of Water Delivered ($/1,000 Gals)	**$3.25**

Charlie Water Supply Corporation

Assumption: Construct Nitrate Removal Plant
Need: Water Quality – 10 AF/YR

Construction Costs:	
Nitrate Removal System	$90,000
Building	45,000
Evaporation Pond	3,000
Other Costs:	
Engineering, Contingencies & Legal @ 30%	41,500
Easement and Land	15,000
Interest During Construction	6,000
Total capital Costs:	**$200,500**
Annual Costs:	
Debt Service (20 yrs @ 6%)	17,500
Operation and Maintenance	5,000
Pumping Cost	3,000
Total Annual Cost	**$25,500**
Available Water (AF/YR)	10
Available Water (MGD)	0.01
Cost of Water Delivered ($/AF)	**$2,550**
Cost of Water Delivered ($/1000 Gals)	**$7.83**

Hinds-Wildcat System – Option 1

Assumption: Construct Nitrate Removal Plant
Need: Water Quality – 40 AF/YR

Construction Cost:	
Ion-Exchange Equipment	$175,000
Building/Electrical	100,000
Evaporation Pond	30,000
Other Project Costs:	
Engineering, Contingencies and Legal @ 30%	91,500
Land Purchase	10,000
Permitting	15,000
Interest During Construction (12 months)	25,000
Total Capital Cost:	**$446,500**
Annual Costs:	
Debt Service (20 yrs. @ 6%)	$39,000
Operation and Maintenance	8,000
Treatment Cost	7,500
Total Annual Costs:	**$54,500**
Available Water (AF/YR)	40
Available Water (MGD)	.03
Cost of Water Delivered ($/AF)	**1,363**
Cost of Water Delivered ($/1,000 Gals)	**$4.18**

Hinds-Wildcat System – Option 2

Assumption: Purchase Water From Vernon
Need: Water Quality – 40 AF/YR

Construction Costs:	
6" Pipeline	$260,000
ROW Costs	25,000
Pump Station	275,000
Road Crossings	10,000
Railroad Crossings	18,000
River Crossings	18,000
Metering Vaults	16,000
Other Project Costs:	
Engineering, Contingencies, & Legal @ 30%	186,000
Mitigation & Permitting	15,000
Interest during construction (6 months)	25,000
Total Capital Costs	**$848,000**
Annual Costs:	
Debt Service (20 years @ 6%)	74,000
Operation and Maintenance	6,500
Pumping Costs	12,000
Water Purchase Costs ($2.14/1000 Gals)	29,500
Total Annual Costs	**$122,000**
Available Water (AF/YR)	40
Available Water (MGD)	0.03
Cost of Water Delivered ($/AF)	**$3,050**
Cost of Water Delivered ($/1000 Gals)	**$9.36**

Lockett Water System

Assumption: Purchase Water from Vernon
Need: Water Quality – 109 AF/YR

Construction Costs:	
6" Pipeline	$875,000
ROW Costs	84,000
Pump Station	150,000
Highway Crossings	54,000
Metering Vaults	16,000
Subtotal Construction Costs	1,179,000
Other Project Costs:	
Engineering, Contingencies and Legal @ 30%	$353,700
Mitigation & Permitting	32,000
Interest During Construction (12 months)	94,000
Total Capital Project Costs:	**$1,658,700**
Annual Costs	
Debt Service (20 years @ 6%)	$145,000
Operation and Maintenance	13,000
Pumping Costs	9,000
Water Purchase Costs	80,000
Total Annual Costs:	**$247,000**
Available Water (AF/YR)	109
Available Water (MGD)	0.10
Cost of Water Delivered ($/AF)	**$2,266**
Cost of Water Delivered ($/1,000 Gals)	**$6.96**

Lake Kemp Improvements

Assumption: Increase Conservation Level and Provide Seasonal Pool
Need: 23,000 AF/YR

Construction Costs:	0
Other Project Costs:	
Engineering, Contingencies and Legal	$130,000
Total Capital Costs:	**$130,000**
Annual Costs:	
Debt Service (20 yrs @ 6%)	$11,500
Total Annual Costs:	**$11,500**
Available Water (AF/YR)	23,000
Available Water (MGD)	20
Cost of Water Delivered ($/AF)	**$0.50**
Cost of Water Delivered ($/1,000 Gals)	**$0.01**

Irrigation Canal Improvements

Assumption: Enclose Laterals in Pipe
Water Available: 13,034 AF/YR

Construction Costs:	
Install 36" Pipe in Laterals	469,800
Install 30" Pipe in Laterals	1,597,500
Install 27" Pipe in Laterals	990,000
Install 24" Pipe in Laterals	2,062,080
Install 18" Pipe in Laterals	718,850
Install 15" Pipe in Laterals	52,900
Other Project Costs:	
Engineering, Contingencies and Legal @ 30%	1,767,339
Total Capital Costs:	**$7,658,469**
Annual Costs:	
Debt Service (20 yrs @ 6%)	$667,700
Operation and Maintenance	6,678
Total Annual Costs:	**$674,378**
Available Water (AF/YR)	13,034
Available Water (MGD)	11.6
Cost of Water Delivered ($/AF)	**$52**
Cost of Water Delivered ($/1,000 Gals)	**$0.16**

Wichita River Diversion

Assumption: Divert water from Wichita River into Northside Canal
Available Water: 8,850 AF/YR

Construction Costs:	
36" Pipeline (5,000 LF)	$925,000
ROW Costs	30,000
Pump Station	2,000,000
Diversion Structure	1,000,000
Other Project Costs:	
Engineering, Contingencies, & Legal @ 30%	1,200,000
Interest during construction (12 months)	225,000
Total Capital Costs	**$5,380,000**
Annual Costs:	
Debt Service (20 years @ 6%)	469,000
Operation and Maintenance	75,000
Pumping Costs	100,000
Total Annual Costs	**$644,000**
Available Water (AF/YR)	8,850
Available Water (MGD)	8.0
Cost of Water Delivered ($/AF)	**$73.00**
Cost of Water Delivered ($/1000 Gals)	**$0.22**

Montague County Mining – Option 1

Assumption: Develop Additional Groundwater Supply
Need: 177 AF/YR (FIRM)

Construction Costs:	
Water Supply Well	$150,000
6" Transmission Line	300,000
Other Project Costs:	
Engineering, Contingencies, & Legal @ 30%	135,000
Land & Easements	50,000
Interest During Const. (6 months)	19,000
Total Capital Costs:	**$654,000**
Annual Costs:	
Debt Service (20 yrs @ 6%)	$57,025
Operation & Maint.	$10,000
Pumping Costs	$12,000
Total Annual Costs:	**$79,025**
Available Water (AF/YR)	177
Available Water (MGD)	0.16
Cost of Water Delivered ($/AF)	**$447**
Cost of Water Delivered ($/1,000 Gals)	**$1.37**

Montague County Mining – Option 2

Assumption: Purchase Water from Local Provider
Need: 177 AF (FIRM)

Construction Costs:	
6" Transmission Line	$300,000
Other Project Costs:	
Engineering, Contingencies & Legal @ 30%	90,000
Pipeline Easements	10,000
Interest During Const. (6 months)	12,000
Total Capital Costs:	**$412,000**
Annual Costs:	
Debt Services (20 yrs. @ 6%)	$36,000
Operation & Maint.	$3,000
Water Purchases ($3.50/1,000 Gals)	$202,000
Total Annual Costs:	**$241,000**
Available Water (AF/YR)	177
Available Water (MGD)	0.16
Annual Cost of Water Delivered ($/AF)	**$1,362**
Annual Cost of Water Delivered ($/1,000 Gals)	**$4.18**

Regional Water Strategy

Assumption: Construct Chloride Control Project
Need: 26,500 AF/YR

Construction Costs:	
Raise Truscott Brine Reservoir Dam	$26,000,000
Construct North Fork Wichita River Dam	24,000,000
Construct Pipeline from Middle Fork Wichita River to Truscott Brine Reservoir (14 miles)	4,500,000
Replace Pipeline from South Fork Wichita River to Truscott Brine Reservoir (22 miles)	10,500,000
Other Project Costs:	
Engineering, Contingencies and Legal (30%)	19,500,000
Land and Easements	500,000
Environmental Studies, Mitigation, Permitting	250,000
Interest During Construction (24 months)	10,200,000
Total Capital Project Costs	**$95,450,000**
Annual Costs:	
Debt Service (40 years @ 6%)	$6,347,425
Operation and Maintenance	975,000
Power Costs	250,000
Total Annual Costs	**$7,572,425**
Available Water (AF/YR)	26,500
Available Water (MGD)	23.7
Cost of Water Delivered ($/AF)	**$286**
Cost of Water Delivered ($/1,000 gals)	**$0.88**

ATTACHMENT 4-3

REGIONAL WATER PLANNING GROUP B

SOCIOECONOMIC IMPACTS OF UNMET WATER NEEDS

Socioeconomic Impacts of Projected Water Shortages for the Region B Regional Water Planning Area

Prepared in Support of the 2011 Region B Water Plan

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Introduction

Water shortages during drought would likely curtail or eliminate economic activity in business and industries reliant on water. For example, without water farmers cannot irrigate; refineries cannot produce gasoline, and paper mills cannot make paper. Unreliable water supplies would not only have an immediate and real impact on existing businesses and industry, but they could also adversely affect economic development in Texas. From a social perspective, water supply reliability is critical as well. Shortages would disrupt activity in homes, schools and government and could adversely affect public health and safety. For all of the above reasons, it is important to analyze and understand how restricted water supplies during drought could affect communities throughout the state.

Administrative rules require that regional water planning groups evaluate the impacts of not meeting water needs as part of the regional water planning process, and rules direct TWDB staff to provide technical assistance: "*The executive administrator shall provide available technical assistance to the regional water planning groups, upon request, on water supply and demand analysis, including methods to evaluate the social and economic impacts of not meeting needs*" [(§357.7 (4)(A)]. Staff of the TWDB's Water Resources Planning Division designed and conducted this report in support of the Region B Regional Water Planning Group.

This document summarizes the results of our analysis and discusses the methodology used to generate the results. Section 1 outlines the overall methodology and discusses approaches and assumptions specific to each water use category (i.e., irrigation, livestock, mining, steam-electric, municipal and manufacturing). Section 2 presents the results for each category where shortages are reported at the regional planning area level and river basin level. Results for individual water user groups are not presented, but are available upon request.

1. Methodology

Section 1 provides a general overview of how economic and social impacts were measured. In addition, it summarizes important clarifications, assumptions and limitations of the study.

1.1 Economic Impacts of Water Shortages

1.1.1 General Approach

Economic analysis as it relates to water resources planning generally falls into two broad areas. Supply side analysis focuses on costs and alternatives of developing new water supplies or implementing programs that provide additional water from current supplies. Demand side analysis concentrates on impacts or benefits of providing water to people, businesses and the environment. Analysis in this report focuses strictly on demand side impacts. When analyzing the economic impacts of water shortages as defined in Texas water planning, three potential scenarios are possible:

1) Scenario 1 involves situations where there are physical shortages of raw surface or groundwater due to drought of record conditions. For example, City A relies on a reservoir with average conservation storage of 500 acre-feet per year and a firm yield of 100 acre feet. In 2010, the city uses about 50 acre-feet per year, but by 2030 their demands are expected to increase to 200 acre-feet. Thus, in 2030 the reservoir would not have enough water to meet the city's demands, and people would experience a shortage of 100 acre-feet assuming drought of record conditions.

Under normal or average climatic conditions, the reservoir would likely be able to provide reliable water supplies well beyond 2030.

2) Scenario 2 is a situation where despite drought of record conditions, water supply sources can meet existing use requirements; however, limitations in water infrastructure would preclude future water user groups from accessing these water supplies. For example, City B relies on a river that can provide 500 acre-feet per year during drought of record conditions and other constraints as dictated by planning assumptions. In 2010, the city is expected to use an estimated 100 acre-feet per year and by 2060 it would require no more than 400 acre-feet. But the intake and pipeline that currently transfers water from the river to the city's treatment plant has a capacity of only 200 acre-feet of water per year. Thus, the city's water supplies are adequate even under the most restrictive planning assumptions, but their conveyance system is too small. This implies that at some point – perhaps around 2030 - infrastructure limitations would constrain future population growth and any associated economic activity or impacts.

3) Scenario 3 involves water user groups that rely primarily on aquifers that are being depleted. In this scenario, projected and in some cases existing demands may be unsustainable as groundwater levels decline. Areas that rely on the Ogallala aquifer are a good example. In some communities in the region, irrigated agriculture forms a major base of the regional economy. With less irrigation water from the Ogallala, population and economic activity in the region could decline significantly assuming there are no offsetting developments.

Assessing the social and economic effects of each of the above scenarios requires various levels and methods of analysis and would generate substantially different results for a number of reasons; the most important of which has to do with the time frame of each scenario. Scenario 1 falls into the general category of static analysis. This means that models would measure impacts for a small interval of time such as a drought. Scenarios 2 and 3, on the other hand imply a dynamic analysis meaning that models are concerned with changes over a much longer time period.

Since administrative rules specify that planning analysis be evaluated under drought of record conditions (a static and random event), socioeconomic impact analysis developed by the TWDB for the state water plan is based on assumptions of Scenario 1. Estimated impacts under scenario 1 are point estimates for years in which needs are reported (2010, 2020, 2030, 2040, 2050 and 2060). They are independent and distinct "what if" scenarios for a particular year and shortages are assumed to be temporary events resulting from drought of record conditions. Estimated impacts measure what would happen if water user groups experience water shortages for a period of one year.

The TWDB recognize that dynamic models may be more appropriate for some water user groups; however, combining approaches on a statewide basis poses several problems. For one, it would require a complex array of analyses and models, and might require developing supply and demand forecasts under "normal" climatic conditions as opposed to drought of record conditions. Equally important is the notion that combining the approaches would produce inconsistent results across regions resulting in a so-called "apples to oranges" comparison.

A variety tools are available to estimate economic impacts, but by far, the most widely used today are input-output models (IO models) combined with social accounting matrices (SAMs). Referred to as IO/SAM models, these tools formed the basis for estimating economic impacts for agriculture (irrigation and livestock water uses) and industry (manufacturing, mining, steam-electric and commercial business activity for municipal water uses).

Since the planning horizon extends through 2060, economic variables in the baseline are adjusted in accordance with projected changes in demographic and economic activity. Growth rates for municipal water use sectors (i.e., commercial, residential and institutional) are based on TWDB population forecasts. Future values for manufacturing, agriculture, and mining and steam-electric activity are based on the same underlying economic forecasts used to estimate future water use for each category.

The following steps outline the overall process.

Step 1*: Generate IO/SAM Models and Develop Economic Baseline*

IO/SAM models were estimated using propriety software known as IMPLAN PRO™ (Impact for Planning Analysis). IMPLAN is a modeling system originally developed by the U.S. Forestry Service in the late 1970s. Today, the Minnesota IMPLAN Group (MIG Inc.) owns the copyright and distributes data and software. It is probably the most widely used economic impact model in existence. IMPLAN comes with databases containing the most recently available economic data from a variety of sources.[1] Using IMPLAN software and data, transaction tables conceptually similar to the one discussed previously were estimated for each county in the region and for the region as a whole. Each transaction table contains 528 economic sectors and allows one to estimate a variety of economic statistics including:

- **total sales -** total production measured by sales revenues;
- **intermediate sales -** sales to other businesses and industries within a given region;
- **final sales –** sales to end users in a region and exports out of a region**;**
- **employment -** number of full and part-time jobs (annual average) required by a given industry including self-employment;
- **regional income -** total payroll costs (wages and salaries plus benefits) paid by industries, corporate income, rental income and interest payments; and
- **business taxes -** sales, excise, fees, licenses and other taxes paid during normal operation of an industry (does not include income taxes).

TWDB analysts developed an economic baseline containing each of the above variables using year 2000 data. Since the planning horizon extends through 2060, economic variables in the baseline were allowed to change in accordance with projected changes in demographic and economic activity. Growth rates for municipal water use sectors (i.e., commercial, residential and institutional) are based on TWDB population forecasts. Projections for manufacturing, agriculture, and mining and steam-electric activity are based on the same underlying economic forecasts used to estimate future water use for each category. Monetary impacts in future years are reported in constant year 2006 dollars.

It is important to stress that employment, income and business taxes are the most useful variables when comparing the relative contribution of an economic sector to a regional economy. Total sales as reported in IO/SAM models are less desirable and can be misleading because they include sales to other industries in the region for use in the production of other goods. For example, if a mill buys grain from local farmers and uses it to produce feed, sales of both the processed feed and raw corn are counted as "output" in an IO model. Thus, total sales double-count or overstate the true economic value of goods

[1]The IMPLAN database consists of national level technology matrices based on benchmark input-output accounts generated by the U.S. Bureau of Economic Analysis and estimates of final demand, final payments, industry output and employment for various economic sectors. IMPLAN regional data (i.e. states, a counties or groups of counties within a state) are divided into two basic categories: 1) data on an industry basis including value-added, output and employment, and 2) data on a commodity basis including final demands and institutional sales. State-level data are balanced to national totals using a matrix ratio allocation system and county data are balanced to state totals.

and services produced in an economy. They are not consistent with commonly used measures of output such as Gross National Product (GNP), which counts only final sales.

Another important distinction relates to terminology. Throughout this report, the term *sector* refers to economic subdivisions used in the IMPLAN database and resultant input-output models (528 individual sectors based on Standard Industrial Classification Codes). In contrast, the phrase *water use category* refers to water user groups employed in state and regional water planning including irrigation, livestock, mining, municipal, manufacturing and steam electric. Each IMPLAN sector was assigned to a specific water use category.

Step 2: *Estimate Direct and Indirect Economic Impacts of Water Needs*

Direct impacts are reductions in output by sectors experiencing water shortages. For example, without adequate cooling and process water a refinery would have to curtail or cease operation, car washes may close, or farmers may not be able to irrigate and sales revenues fall. Indirect impacts involve changes in inter-industry transactions as supplying industries respond to decreased demands for their services, and how seemingly non-related businesses are affected by decreased incomes and spending due to direct impacts. For example, if a farmer ceases operations due to a lack of irrigation water, they would likely reduce expenditures on supplies such as fertilizer, labor and equipment, and businesses that provide these goods would suffer as well.

Direct impacts accrue to immediate businesses and industries that rely on water and without water industrial processes could suffer. However, output responses may vary depending upon the severity of shortages. A small shortage relative to total water use would likely have a minimal impact, but large shortages could be critical. For example, farmers facing small shortages might fallow marginally productive acreage to save water for more valuable crops. Livestock producers might employ emergency culling strategies, or they may consider hauling water by truck to fill stock tanks. In the case of manufacturing, a good example occurred in the summer of 1999 when Toyota Motor Manufacturing experienced water shortages at a facility near Georgetown, Kentucky.[2] As water levels in the Kentucky River fell to historic lows due to drought, plant managers sought ways to curtail water use such as reducing rinse operations to a bare minimum and recycling water by funneling it from paint shops to boilers. They even considered trucking in water at a cost of 10 times what they were paying. Fortunately, rains at the end of the summer restored river levels, and Toyota managed to implement cutbacks without affecting production, but it was a close call. If rains had not replenished the river, shortages could have severely reduced output.[3]

To account for uncertainty regarding the relative magnitude of impacts to farm and business operations, the following analysis employs the concept of elasticity. Elasticity is a number that shows how a change in one variable will affect another. In this case, it measures the relationship between a percentage reduction in water availability and a percentage reduction in output. For example, an elasticity of 1.0 indicates that a 1.0 percent reduction in water availability would result in a 1.0 percent reduction in economic output. An elasticity of 0.50 would indicate that for every 1.0 percent of unavailable water, output is reduced by 0.50 percent and so on. Output elasticities used in this study are:[4]

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[2] Royal, W. "*High And Dry - Industrial Centers Face Water Shortages*." in Industry Week, Sept, 2000.

[3] The efforts described above are not planned programmatic or long-term operational changes. They are emergency measures that individuals might pursue to alleviate what they consider a temporary condition. Thus, they are not characteristic of long-term management strategies designed to ensure more dependable water supplies such as capital investments in conservation technology or development of new water supplies.

[4] Elasticities are based on one of the few empirical studies that analyze potential relationships between economic output and water shortages in the United States. The study, conducted in California, showed that a significant number of industries would suffer reduced output during water shortages. Using a survey based approach researchers posed two scenarios to different industries. In

- if water needs are 0 to 5 percent of total water demand, no corresponding reduction in output is assumed;

- if water needs are 5 to 30 percent of total water demand, for each additional one percent of water need that is not met, there is a corresponding 0.50 percent reduction in output;

- if water needs are 30 to 50 percent of total water demand, for each additional one percent of water need that is not met, there is a corresponding 0.75 percent reduction in output; and

- if water needs are greater than 50 percent of total water demand, for each additional one percent of water need that is not met, there is a corresponding 1.0 percent (i.e., a proportional reduction).

In some cases, elasticities are adjusted depending upon conditions specific to a given water user group.

Once output responses to water shortages were estimated, direct impacts to total sales, employment, regional income and business taxes were derived using regional level economic multipliers estimating using IO/SAM models. The formula for a given IMPLAN sector is:

$D_{i,t} = Q_{i,t} *_{,} S_{i,t} * E_Q * RFD_i * DM_{i(Q, L, I, T)}$

where:

$D_{i,t}$ = direct economic impact to sector *i* in period *t*

$Q_{i,t}$ = total sales for sector *i* in period *t* in an affected county

$RFD_{i,}$ = ratio of final demand to total sales for sector *i* for a given region

$S_{i,t}$ = water shortage as percentage of total water use in period *t*

E_Q = elasticity of output and water use

$DM_{i(L, I, T)}$ = direct output multiplier coefficients for labor (L), income (I) and taxes (T) for sector *i*.

Secondary impacts were derived using the same formula used to estimate direct impacts; however, indirect multiplier coefficients are used. Methods and assumptions specific to each water use sector are discussed in Sections 1.1.2 through 1.1.4.

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the first scenario, they asked how a 15 percent cutback in water supply lasting one year would affect operations. In the second scenario, they asked how a 30 percent reduction lasting one year would affect plant operations. In the case of a 15 percent shortage, reported output elasticities ranged from 0.00 to 0.76 with an average value of 0.25. For a 30 percent shortage, elasticities ranged from 0.00 to 1.39 with average of 0.47. For further information, see, California Urban Water Agencies, "*Cost of Industrial Water Shortages,*" Spectrum Economics, Inc. November, 1991.

General Assumptions and Clarification of the Methodology

As with any attempt to measure and quantify human activities at a societal level, assumptions are necessary and every model has limitations. Assumptions are needed to maintain a level of generality and simplicity such that models can be applied on several geographic levels and across different economic sectors. In terms of the general approach used here several clarifications and cautions are warranted:

1. Shortages as reported by regional planning groups are the starting point for socioeconomic analyses.

2. Estimated impacts are point estimates for years in which needs are reported (i.e., 2010, 2020, 2030, 2040, 2050 and 2060).They are independent and distinct "what if" scenarios for each particular year and water shortages are assumed to be temporary events resulting from severe drought conditions combined with infrastructure limitations. In other words, growth occurs and future shocks are imposed on an economy at 10-year intervals and resultant impacts are measured. Given, that reported figures are not cumulative in nature, it is inappropriate to sum impacts over the entire planning horizon. Doing so, would imply that the analysis predicts that drought of record conditions will occur every ten years in the future, which is not the case. Similarly, authors of this report recognize that in many communities needs are driven by population growth, and in the future total population will exceed the amount of water available due to infrastructure limitations, regardless of whether or not there is a drought. This implies that infrastructure limitations would constrain economic growth. However, since needs as defined by planning rules are based upon water supply and demand under the assumption of drought of record conditions, it improper to conduct economic analysis that focuses on growth related impacts over the planning horizon. Figures generated from such an analysis would presume a 50-year drought of record, which is unrealistic. Estimating lost economic activity related to constraints on population and commercial growth due to lack of water would require developing water supply and demand forecasts under "normal" or "most likely" future climatic conditions.

3. While useful for planning purposes, this study is not a benefit-cost analysis. Benefit cost analysis is a tool widely used to evaluate the economic feasibility of specific policies or projects as opposed to estimating economic impacts of unmet water needs. Nevertheless, one could include some impacts measured in this study as part of a benefit cost study if done so properly. Since this is not a benefit cost analysis, future impacts are not weighted differently. In other words, estimates are not discounted. If used as a measure of economic benefits, one should incorporate a measure of uncertainty into the analysis. In this type of analysis, a typical method of discounting future values is to assign probabilities of the drought of record recurring again in a given year, and weight monetary impacts accordingly. This analysis assumes a probability of one.

4. IO multipliers measure the strength of backward linkages to supporting industries (i.e., those who sell inputs to an affected sector). However, multipliers say nothing about forward linkages consisting of businesses that purchase goods from an affected sector for further processing. For example, ranchers in many areas sell most of their animals to local meat packers who process animals into a form that consumers ultimately see in grocery stores and restaurants. Multipliers do not capture forward linkages to meat packers, and since meat packers sell livestock purchased from ranchers as "final sales," multipliers for the ranching sector do fully account for all losses to a region's economy. Thus, as mentioned previously, in some cases closely linked sectors were moved from one water use category to another.

5. Cautions regarding interpretations of direct and secondary impacts are warranted. IO/SAM multipliers are based on "fixed-proportion production functions," which basically means that input use - including labor - moves in lockstep fashion with changes in levels of output. In a

scenario where output (i.e., sales) declines, losses in the immediate sector or supporting sectors could be much less than predicted by an IO/SAM model for several reasons. For one, businesses will likely expect to continue operating so they might maintain spending on inputs for future use; or they may be under contractual obligations to purchase inputs for an extended period regardless of external conditions. Also, employers may not lay-off workers given that experienced labor is sometimes scarce and skilled personnel may not be readily available when water shortages subside. Lastly people who lose jobs might find other employment in the region. As a result, direct losses for employment and secondary losses in sales and employment should be considered an upper bound. Similarly, since projected population losses are based on reduced employment in the region, they should be considered an upper bound as well.

6. IO models are static. Models and resultant multipliers are based upon the structure of the U.S. and regional economies in 2006. In contrast, water shortages are projected to occur well into the future. Thus, the analysis assumes that the general structure of the economy remains the same over the planning horizon, and the farther out into the future we go, this assumption becomes less reliable.

7. Impacts are annual estimates. If one were to assume that conditions persisted for more than one year, figures should be adjusted to reflect the extended duration. The drought of record in most regions of Texas lasted several years.

8. Monetary figures are reported in constant year 2006 dollars.

1.1.2 Impacts to Agriculture

Irrigated Crop Production

The first step in estimating impacts to irrigation required calculating gross sales for IMPLAN crop sectors. Default IMPLAN data do not distinguish irrigated production from dry-land production. Once gross sales were known other statistics such as employment and income were derived using IMPLAN direct multiplier coefficients. Gross sales for a given crop are based on two data sources:

1) county-level statistics collected and maintained by the TWDB and the USDA Farm Services Agency (FSA) including the number of irrigated acres by crop type and water application per acre, and

2) regional-level data published by the Texas Agricultural Statistics Service (TASS) including prices received for crops (marketing year averages), crop yields and crop acreages.

Crop categories used by the TWDB differ from those used in IMPLAN datasets. To maintain consistency, sales and other statistics are reported using IMPLAN crop classifications. Table 1 shows the TWDB crops included in corresponding IMPLAN sectors, and Table 2 summarizes acreage and estimated annual water use for each crop classification (five-year average from 2003-2007).

Table 1: Crop Classifications Used in TWDB Water Use Survey and Corresponding IMPLAN Crop Sectors	
IMPLAN category	**TWDB category**
Oilseeds	Soybeans and "other oil crops"
Grains	Grain sorghum, corn, wheat and "other grain crops"
Vegetable and melons	"Vegetables" and potatoes
Tree nuts	Pecans
Fruits	Citrus, vineyard and other orchard
Cotton	Cotton
Sugarcane and sugar beets	Sugarcane and sugar beets
All "other" crops	"Forage crops", peanuts, alfalfa, hay and pasture, rice and "all other crops"

Table 2: Summary of Irrigated Crop Acreage and Water Demand for the Region B Regional Water Planning Area (average 2003-2007)

Sector	Acres (1000s)	Distribution of acres	Water use (1000s of AF)	Distribution of water use
Oilseeds	0	0%	0	0%
Grains	8	17%	7	9%
Vegetable and melons	1	1%	1	<1%
Tree nuts	<1%	<1%	1	<1%
Fruits	<1%	<1%	<1%	<1%
Cotton	8	18%	9	11%
All other crops	29	62%	62	78%
Total	46	100%	719	100%

Table 3: Average Gross Sales Revenues per Acre for Irrigated Crops for the Region B Regional Water Planning Area (2003-2007)		
IMPLAN Sector	**Gross revenues per acre**	**Crops included in estimates**
Grains	$153	Based on five-year (2003-2007) average weighted by acreage for "irrigated grain sorghum," "irrigated corn", "irrigated wheat" and "irrigated 'other' grain crops."
Vegetable and melons	$6,119	Based on five-year (2003-2007) average weighted by acreage for "irrigated shallow and deep root vegetables", "irrigated Irish potatoes" and "irrigated melons."
Tree nuts	$3,371	Based on five-year (2003-2007) average weighted by acreage for "irrigated pecans."
Fruits	$2,679	Based on five-year (2003-2007) average weighted by acreage for "irrigated citrus", "irrigated vineyards" and "irrigated 'other' orchard."
Cotton	$492	Based on five-year (2003-2007) average weighted by acreage for "irrigated cotton."
All Other Crops	$417	Irrigated figure is based on five-year (2003-2007) average weighted by acreage for "irrigated 'forage' crops", "irrigated peanuts", "irrigated alfalfa", "irrigated 'hay' and pasture" and "irrigated 'all other' crops."

*Figures are rounded. Source: Based on data from the Texas Agricultural Statistics Service, Texas Water Development Board, and Texas A&M University.

The following steps outline the overall process used to estimate direct impacts to irrigated agriculture:

1. *Distribute shortages across predominant crop types in the region*. Again, unmet water needs were distributed equally across crop sectors that constitute one percent or more of irrigated acreage.

2. *Estimate associated reductions in output for affected crop sectors*. Output reductions are based on elasticities discussed previously and on estimated values per acre for different crops. Values per acre stem from the same data used to estimate output for the year 2006 baseline. Using

multipliers, we then generate estimates of forgone income, jobs, and tax revenues based on reductions in gross sales and final demand.

3. *Reduce sales revenues for forward processers in proportion to lost rice production*. As discussed in Section 1.1, input output models capture indirect losses to suppliers and other businesses that depend upon rice farming, but only those providing inputs to rice production. Multipliers do not capture potential impacts to forward processors, in this case rice mills, which add considerable value to the product and hence income and jobs to the state. For example, Texas rice farming directly generates about $60 to $80 in gross state product. Once the rice harvested it is sold to rice mills that process and resell the crop. This added value generates an additional $60 to $80 million in direct gross state product. Impacts measured in the study capture this additional value added.

Livestock

The approach used for the livestock sector is basically the same as that used for crop production. As is the case with crops, livestock categorizations used by the TWDB differ from those used in IMPLAN datasets, and TWDB groupings were assigned to a given IMPLAN sector (Table 4). Then we:

1) *Distribute projected water needs equally among predominant livestock sectors and estimate lost output*: As is the case with irrigation, shortages are assumed to affect all livestock sectors equally; however, the category of "other" is not included given its small size. If water needs were small relative to total demands, we assume that producers would haul in water by truck to fill stock tanks. The cost per acre-foot ($24,000) is based on 2008 rates charged by various water haulers in Texas, and assumes that the average truck load is 6,500 gallons at a hauling distance of 60 miles.

3) *Estimate reduced output in forward processors for livestock sectors*. Reductions in output for livestock sectors are assumed to have a proportional impact on forward processors in the region such as meat packers. In other words, if the cows were gone, meat-packing plants or fluid milk manufacturers) would likely have little to process. This is not an unreasonable premise. Since the 1950s, there has been a major trend towards specialized cattle feedlots, which in turn has decentralized cattle purchasing from livestock terminal markets to direct sales between producers and slaughterhouses. Today, the meat packing industry often operates large processing facilities near high concentrations of feedlots to increase capacity utilization.[5] As a result, packers are heavily dependent upon nearby feedlots. For example, a recent study by the USDA shows that on average meat packers obtain 64 percent of cattle from within 75 miles of their plant, 82 percent from within 150 miles and 92 percent from within 250 miles.[6]

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[5] Ferreira, W.N. "*Analysis of the Meat Processing Industry in the United States*." Clemson University Extension Economics Report ER211, January 2003.

[6] Ward, C.E. "*Summary of Results from USDA's Meatpacking Concentration Study*." Oklahoma Cooperative Extension Service, OSU Extension Facts WF-562.

Table 4: Description of Livestock Sectors	
IMPLAN Category	**TWDB Category**
Cattle ranching	Cattle, cow calf, feedlots and dairies
Poultry and egg production	Poultry production.
Other livestock	Livestock other than cattle and poultry (i.e., horses, goats, sheep, hogs)
Milk manufacturing	Fluid milk manufacturing, cheese manufacturing, ice cream manufacturing etc.
Meat packing	Meat processing present in the region from slaughter to final processing

1.1.3 Impacts to Municipal Water User Groups

Disaggregation of Municipal Water Demands

Estimating the economic impacts for the municipal water user groups is complicated for a number of reasons. For one, municipal use comprises a range of consumers including commercial businesses, institutions such as schools and government and households. However, reported water needs are not distributed among different municipal water users. In other words, how much of a municipal need is commercial and how much is residential (domestic)?

The amount of commercial water use as a percentage of total municipal demand was estimated based on "GED" coefficients (gallons per employee per day) published in secondary sources.[7] For example, if year 2006 baseline data for a given economic sector (e.g., amusement and recreation services) shows employment at 30 jobs and the GED coefficient is 200, then average daily water use by that sector is (30 x 200 = 6,000 gallons) or 6.7 acre-feet per year. Water not attributed to commercial use is considered domestic, which includes single and multi-family residential consumption, institutional uses and all use designated as "county-other." Based on our analysis, commercial water use is about 5 to 35 percent of municipal demand. Less populated rural counties occupy the lower end of the spectrum, while larger metropolitan counties are at the higher end.

After determining the distribution of domestic versus commercial water use, we developed methods for estimating impacts to the two groups.

Domestic Water Uses

Input output models are not well suited for measuring impacts of shortages for domestic water uses, which make up the majority of the municipal water use category. To estimate impacts associated

[7] Sources for GED coefficients include: Gleick, P.H., Haasz, D., Henges-Jeck, C., Srinivasan, V., Wolff, G. Cushing, K.K., and Mann, A. "*Waste Not, Want Not*: *The Potential for Urban Water Conservation in California*." Pacific Institute. November 2003. U.S. Bureau of the Census. 1982 Census of Manufacturers: Water Use in Manufacturing. USGPO, Washington D.C. See also: "*U.S. Army Engineer Institute for Water Resources, IWR Report 88-R-6.*," Fort Belvoir, VA. See also, Joseph, E. S., 1982, "*Municipal and Industrial Water Demands of the Western United States*." Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, v. 108, no. WR2, p. 204-216. See also, Baumann, D. D., Boland, J. J., and Sims, J. H., 1981, "*Evaluation of Water Conservation for Municipal and Industrial Water Supply*." U.S. Army Corps of Engineers, Institute for Water Resources, Contract no. 82-C1.

with domestic water uses, municipal water demand and needs are subdivided into residential, and commercial and institutional use. Shortages associated with residential water uses are valued by estimating proxy demand functions for different water user groups allowing us to estimate the marginal value of water, which would vary depending upon the level of water shortages. The more severe the water shortage, the more costly it becomes. For instance, a 2 acre-foot shortage for a group of households that use 10 acre-feet per year would not be as severe as a shortage that amounted to 8 acre-feet. In the case of a 2 acre-foot shortage, households would probably have to eliminate some or all outdoor water use, which could have implicit and explicit economic costs including losses to the horticultural and landscaping industry. In the case of an 8 acre-foot shortage, people would have to forgo all outdoor water use and most indoor water consumption. Economic impacts would be much higher in the latter case because people, and would be forced to find emergency alternatives assuming alternatives were available.

To estimate the value of domestic water uses, TWDB staff developed marginal loss functions based on constant elasticity demand curves. This is a standard and well-established method used by economists to value resources such as water that have an explicit monetary cost.

A constant price elasticity of demand is estimated using a standard equation:

$$w = kc^{(-\varepsilon)}$$

where:

- w is equal to average monthly residential water use for a given water user group measured in thousands of gallons;
- k is a constant intercept;
- c is the average cost of water per 1,000 gallons; and
- ε is the price elasticity of demand.

Price elasticities (-0.30 for indoor water use and -0.50 for outdoor use) are based on a study by Bell et al.[8] that surveyed 1,400 water utilities in Texas that serve at least 1,000 people to estimate demand elasticity for several variables including price, income, weather etc. Costs of water and average use per month per household are based on data from the Texas Municipal League's annual water and wastewater rate surveys - specifically average monthly household expenditures on water and wastewater in different communities across the state. After examining variance in costs and usage, three different categories of water user groups based on population (population less than 5,000, cities with populations ranging from 5,000 to 99,999 and cities with populations exceeding 100,000) were selected to serve as proxy values for municipal water groups that meet the criteria (Table 5).[9]

[8] Bell, D.R. and Griffin, R.C. "*Community Water Demand in Texas as a Century is Turned*." Research contract report prepared for the Texas Water Development Board. May 2006.

[9] Ideally, one would want to estimate demand functions for each individual utility in the state. However, this would require an enormous amount of time and resources. For planning purposes, we believe the values generated from aggregate data are more than sufficient.

Table 5: Water Use and Costs Parameters Used to Estimated Water Demand Functions (average monthly costs per acre-foot for delivered water and average monthly use per household)				
Community Population	**Water**	**Wastewater**	**Total Monthly Cost**	**Avg. Monthly Use (gallons)**
Less than or equal to 5,000	$1,335	$1,228	$2,563	6,204
5,000 to 100,000	$1,047	$1,162	$2,209	7,950
Great than or equal to 100,000	$718	$457	$1,190	8,409
Source: Based on annual water and wastewater rate surveys published by the Texas Municipal League.				

As an example, Table 6 shows the economic impact per acre-foot of domestic water needs for municipal water user groups with population exceeding 100,000 people. There are several important assumptions incorporated in the calculations:

1) Reported values are net of the variable costs of treatment and distribution such as expenses for chemicals and electricity since using less water involves some savings to consumers and utilities alike; and for outdoor uses we do not include any value for wastewater.

2) Outdoor and "non-essential" water uses would be eliminated before indoor water consumption was affected, which is logical because most water utilities in Texas have drought contingency plans that generally specify curtailment or elimination of outdoor water use during droughts.[10] Determining how much water is used for outdoor purposes is based on several secondary sources. The first is a major study sponsored by the American Water Works Association, which surveyed cities in states including Colorado, Oregon, Washington, California, Florida and Arizona. On average across all cities surveyed 58 percent of single family residential water use was for outdoor activities. In cities with climates comparable to large metropolitan areas of Texas, the average was 40 percent.[11] Earlier findings of the U.S. Water Resources Council showed a national average of 33 percent. Similarly, the United States Environmental Protection Agency (USEPA) estimated that landscape watering accounts for 32 percent of total residential and commercial water use on annual basis.[12] A study conducted for the California Urban Water Agencies (CUWA) calculated average annual values ranging from 25 to 35 percent.[13] Unfortunately, there does not appear to be any comprehensive research that has estimated non-agricultural outdoor water use in Texas. As an approximation, an

[10] In Texas, state law requires retail and wholesale water providers to prepare and submit plans to the Texas Commission on Environmental Quality (TCEQ). Plans must specify demand management measures for use during drought including curtailment of "non-essential water uses." Non-essential uses include, but are not limited to, landscape irrigation and water for swimming pools or fountains. For further information see the Texas Environmental Quality Code §288.20.

[11] See, Mayer, P.W., DeOreo, W.B., Opitz, E.M., Kiefer, J.C., Davis, W., Dziegielewski, D., Nelson, J.O. "*Residential End Uses of Water*." Research sponsored by the American Water Works Association and completed by Aquacraft, Inc. and Planning and Management Consultants, Ltd. (PMCL@CDM).

[12] U.S. Environmental Protection Agency. *"Cleaner Water through Conservation*." USEPA Report no. 841-B-95-002. April, 1995.

[13] Planning and Management Consultants, Ltd. "*Evaluating Urban Water Conservation Programs: A Procedures Manual*." Prepared for the California Urban Water Agencies. February 1992.

average annual value of 30 percent based on the above references was selected to serve as a rough estimate in this study.

3) As shortages approach 100 percent values become immense and theoretically infinite at 100 percent because at that point death would result, and willingness to pay for water is immeasurable. Thus, as shortages approach 80 percent of monthly consumption, we assume that households and non-water intensive commercial businesses (those that use water only for drinking and sanitation would have water delivered by tanker truck or commercial water delivery companies. Based on reports from water companies throughout the state, we estimate that the cost of trucking in water is around $21,000 to $27,000 per acre-feet assuming a hauling distance of between 20 to 60 miles. This is not an unreasonable assumption. The practice was widespread during the 1950s drought and recently during droughts in this decade. For example, in 2000 at the heels of three consecutive drought years Electra - a small town in North Texas - was down to its last 45 days worth of reservoir water when rain replenished the lake, and the city was able to refurbish old wells to provide supplemental groundwater. At the time, residents were forced to limit water use to 1,000 gallons per person per month - less than half of what most people use - and many were having water delivered to their homes by private contractors.[14] In 2003 citizens of Ballinger, Texas, were also faced with a dwindling water supply due to prolonged drought. After three years of drought, Lake Ballinger, which supplies water to more than 4,300 residents in Ballinger and to 600 residents in nearby Rowena, was almost dry. Each day, people lined up to get water from a well in nearby City Park. Trucks hauling trailers outfitted with large plastic and metal tanks hauled water to and from City Park to Ballinger.[15]

[14] Zewe, C. "*Tap Threatens to Run Dry in Texas Town*." July 11, 2000. CNN Cable News Network.

[15] Associated Press, "*Ballinger Scrambles to Finish Pipeline before Lake Dries Up*." May 19, 2003.

Table 6: Economic Losses Associated with Domestic Water Shortages in Communities with Populations Exceeding 100,000 people				
Water shortages as a percentage of total monthly household demands	**No. of gallons remaining per household per day**	**No of gallons remaining per person per day**	**Economic loss (per acre-foot)**	**Economic loss (per gallon)**
1%	278	93	$748	$0.00005
5%	266	89	$812	$0.0002
10%	252	84	$900	$0.0005
15%	238	79	$999	$0.0008
20%	224	75	$1,110	$0.0012
25%	210	70	$1,235	$0.0015
30%[a]	196	65	$1,699	$0.0020
35%	182	61	$3,825	$0.0085
40%	168	56	$4,181	$0.0096
45%	154	51	$4,603	$0.011
50%	140	47	$5,109	$0.012
55%	126	42	$5,727	$0.014
60%	112	37	$6,500	$0.017
65%	98	33	$7,493	$0.02
70%	84	28	$8,818	$0.02
75%	70	23	$10,672	$0.03
80%	56	19	$13,454	$0.04
85%	42	14	$18,091 ($24,000)[b]	$0.05 ($0.07)[b]
90%	28	9	$27,363 ($24,000)	$0.08 ($0.07)
95%	14	5	$55,182 ($24,000)	$0.17 ($0.07)
99%	3	0.9	$277,728 ($24,000)	$0.85 ($0.07)
99.9%	1	0.5	$2,781,377 ($24,000)	$8.53 ($0.07)
100%	0	0	Infinite ($24,000)	Infinite ($0.07)

[a] The first 30 percent of needs are assumed to be restrictions of outdoor water use; when needs reach 30 percent of total demands all outdoor water uses would be restricted. Needs greater than 30 percent include indoor use.

[b] As shortages approach 100 percent the value approaches infinity assuming there are not alternatives available; however, we assume that communities would begin to have water delivered by tanker truck at an estimated cost of $24,000 per acre-foot when shortages breached 85 percent.

Commercial Businesses

Effects of water shortages on commercial sectors were estimated in a fashion similar to other business sectors meaning that water shortages would affect the ability of these businesses to operate. This is particularly true for “water intensive” commercial sectors that are need large amounts of water (in addition to potable and sanitary water) to provide their services. These include:

- car-washes,
- laundry and cleaning facilities,
- sports and recreation clubs and facilities including race tracks,
- amusement and recreation services,
- hospitals and medical facilities,
- hotels and lodging places, and
- eating and drinking establishments.

A key assumption is that commercial operations would not be affected until water shortages were at least 50 percent of total municipal demand. In other words, we assume that residential water consumers would reduce water use including all non-essential uses before businesses were affected.

An example will illustrate the breakdown of municipal water needs and the overall approach to estimating impacts of municipal needs. Assume City A experiences an unexpected shortage of 50 acre-feet per year when their demands are 200 acre-feet per year. Thus, shortages are only 25 percent of total municipal use and residents of City A could eliminate needs by restricting landscape irrigation. City B, on the other hand, has a deficit of 150 acre-feet in 2020 and a projected demand of 200 acre-feet. Thus, total shortages are 75 percent of total demand. Emergency outdoor and some indoor conservation measures could eliminate 50 acre-feet of projected needs, yet 50 acre-feet would still remain. To eliminate” the remaining 50 acre-feet water intensive commercial businesses would have to curtail operations or shut down completely.

Three other areas were considered when analyzing municipal water shortages: 1) lost revenues to water utilities, 2) losses to the horticultural and landscaping industries stemming for reduction in water available for landscape irrigation, and 3) lost revenues and related economic impacts associated with reduced water related recreation.

Water Utility Revenues

Estimating lost water utility revenues was straightforward. We relied on annual data from the “*Water and Wastewater Rate Survey*” published annually by the Texas Municipal League to calculate an average value per acre-foot for water and sewer. For water revenues, average retail water and sewer rates multiplied by total water needs served as a proxy. For lost wastewater, total unmet needs were adjusted for return flow factor of 0.60 and multiplied by average sewer rates for the region. Needs reported as “county-other” were excluded under the presumption that these consist primarily of self-supplied water uses. In addition, 15 percent of water demand and needs are considered non-billed or “unaccountable” water that comprises things such as leakages and water for municipal government functions (e.g., fire departments). Lost tax receipts are based on current rates for the “miscellaneous gross receipts tax, “which the state collects from utilities located in most incorporated cities or towns in Texas. We do not include lost water utility revenues when aggregating impacts of municipal water shortages to regional and state levels to prevent double counting.

Horticultural and Landscaping Industry

The horticultural and landscaping industry, also referred to as the "green Industry," consists of businesses that produce, distribute and provide services associated with ornamental plants, landscape and garden supplies and equipment. Horticultural industries often face big losses during drought. For example, the recent drought in the Southeast affecting the Carolinas and Georgia horticultural and landscaping businesses had a harsh year. Plant sales were down, plant mortality increased, and watering costs increased. Many businesses were forced to close locations, lay off employees, and even file for bankruptcy. University of Georgia economists put statewide losses for the industry at around $3.2 billion during the 3-year drought that ended in 2008.[16] Municipal restrictions on outdoor watering play a significant role. During drought, water restrictions coupled with persistent heat has a psychological effect on homeowners that reduces demands for landscaping products and services. Simply put, people were afraid to spend any money on new plants and landscaping.

In Texas, there do not appear to be readily available studies that analyze the economic effects of water shortages on the industry. However, authors of this report believe negative impacts do and would result in restricting landscape irrigation to municipal water consumers. The difficulty in measuring them is two-fold. First, as noted above, data and research for these types of impacts that focus on Texas are limited; and second, economic data provided by IMPLAN do not disaggregate different sectors of the green industry to a level that would allow for meaningful and defensible analysis.[17]

Recreational Impacts

Recreational businesses often suffer when water levels and flows in rivers, springs and reservoirs fall significantly during drought. During droughts, many boat docks and lake beaches are forced to close, leading to big losses for lakeside business owners and local communities. Communities adjacent to popular river and stream destinations such as Comal Springs and the Guadalupe River also see their business plummet when springs and rivers dry up. Although there are many examples of businesses that have suffered due to drought, dollar figures for drought-related losses to the recreation and tourism industry are not readily available, and very difficult to measure without extensive local surveys. Thus, while they are important, economic impacts are not measured in this study.

Table 7 summarizes impacts of municipal water shortages at differing levels of magnitude, and shows the ranges of economic costs or losses per acre-foot of shortage for each level.

[16] Williams, D. *"Georgia landscapers eye rebound from Southeast drought."* Atlanta Business Chronicle, Friday, June 19, 2009

[17] Economic impact analyses prepared by the TWDB for 2006 regional water plans did include estimates for the horticultural industry. However, year 2000 and prior IMPLAN data were disaggregated to a finer level. In the current dataset (2006), the sector previously listed as "Landscaping and Horticultural Services" (IMPLAN Sector 27) is aggregated into "Services to Buildings and Dwellings" (IMPLAN Sector 458).

Table 7: Impacts of Municipal Water Shortages at Different Magnitudes of Shortages		
Water shortages as percent of total municipal demands	Impacts	Economic costs per acre-foot*
0-30%	✓ Lost water utility revenues ✓ Restricted landscape irrigation and non-essential water uses	$730 - $2,040
30-50%	✓ Lost water utility revenues ✓ Elimination of landscape irrigation and non-essential water uses ✓ Rationing of indoor use	$2,040 - $10,970
>50%	✓ Lost water utility revenues ✓ Elimination of landscape irrigation and non-essential water uses ✓ Rationing of indoor use ✓ Restriction or elimination of commercial water use ✓ Importing water by tanker truck	$10,970 - varies
*Figures are rounded		

1.1.4 Industrial Water User Groups

Manufacturing

Impacts to manufacturing were estimated by distributing water shortages among industrial sectors at the county level. For example, if a planning group estimates that during a drought of record water supplies in County A would only meet 50 percent of total annual demands for manufactures in the county, we reduced output for each sector by 50 percent. Since projected manufacturing demands are based on TWDB Water Uses Survey data for each county, we only include IMPLAN sectors represented in the TWBD survey database. Some sectors in IMPLAN databases are not part of the TWDB database given that they use relatively small amounts of water - primarily for on-site sanitation and potable purposes. To maintain consistency between IMPLAN and TWDB databases, Standard Industrial Classification (SIC) codes both databases were cross referenced in county with shortages. Non-matches were excluded when calculating direct impacts.

Mining

The process of mining is very similar to that of manufacturing. We assume that within a given county, shortages would apply equally to relevant mining sectors, and IMPLAN sectors are cross referenced with TWDB data to ensure consistency.

In Texas, oil and gas extraction and sand and gravel (aggregates) operations are the primary mining industries that rely on large volumes of water. For sand and gravel, estimated output reductions are straightforward; however, oil and gas is more complicated for a number of reasons. IMPLAN does not necessarily report the physical extraction of minerals by geographic local, but rather the sales revenues reported by a particular corporation.

For example, at the state level revenues for IMPLAN sector 19 (oil and gas extraction) and sector 27 (drilling oil and gas wells) totals $257 billion. Of this, nearly $85 billion is attributed to Harris County. However, only a very small fraction (less than one percent) of actual production takes place in the county. To measure actual potential losses in well head capacity due to water shortages, we relied on county level production data from the Texas Railroad Commission (TRC) and average well-head market prices for crude and gas to estimate lost revenues in a given county. After which, we used to IMPLAN ratios to estimate resultant losses in income and employment.

Other considerations with respect to mining include:

1) Petroleum and gas extraction industry only uses water in significant amounts for secondary recovery. Known in the industry as enhanced or water flood extraction, secondary recovery involves pumping water down injection wells to increase underground pressure thereby pushing oil or gas into other wells. IMPLAN output numbers do not distinguish between secondary and non-secondary recovery. To account for the discrepancy, county-level TRC data that show the proportion of barrels produced using secondary methods were used to adjust IMPLAN data to reflect only the portion of sales attributed to secondary recovery.

2) A substantial portion of output from mining operations goes directly to businesses that are classified as manufacturing in our schema. Thus, multipliers measuring backward linkages for a given manufacturer might include impacts to a supplying mining operation. Care was taken not to double count in such situations if both a mining operation and a manufacturer were reported as having water shortages.

Steam-electric

At minimum without adequate cooling water, power plants cannot safely operate. As water availability falls below projected demands, water levels in lakes and rivers that provide cooling water would also decline. Low water levels could affect raw water intakes and outfalls at electrical generating units in several ways. For one, power plants are regulated by thermal emission guidelines that specify the maximum amount of heat that can go back into a river or lake via discharged cooling water. Low water levels could result in permit compliance issues due to reduced dilution and dispersion of heat and subsequent impacts on aquatic biota near outfalls.[18] However, the primary concern would be a loss of head (i.e., pressure) over intake structures that would decrease flows through intake tunnels. This would affect safety related pumps, increase operating costs and/or result in sustained shut-downs. Assuming plants did shutdown, they would not be able to generate electricity.

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[18] Section 316 (b) of the Clean Water Act requires that thermal wastewater discharges do not harm fish and other wildlife.

Among all water use categories steam-electric is unique and cautions are needed when applying methods used in this study. Measured changes to an economy using input-output models stem directly from changes in sales revenues. In the case of water shortages, one assumes that businesses will suffer lost output if process water is in short supply. For power generation facilities this is true as well. However, the electric services sector in IMPLAN represents a corporate entity that may own and operate several electrical generating units in a given region. If one unit became inoperable due to water shortages, plants in other areas or generation facilities that do not rely heavily on water such as gas powered turbines might be able to compensate for lost generating capacity. Utilities could also offset lost production via purchases on the spot market.[19] Thus, depending upon the severity of the shortages and conditions at a given electrical generating unit, energy supplies for local and regional communities could be maintained. But in general, without enough cooling water, utilities would have to throttle back plant operations, forcing them to buy or generate more costly power to meet customer demands.

Measuring impacts end users of electricity is not part of this study as it would require extensive local and regional level analysis of energy production and demand. To maintain consistency with other water user groups, impacts of steam-electric water shortages are measured in terms of lost revenues (and hence income) and jobs associated with shutting down electrical generating units.

1.2 Social Impacts of Water Shortages

As the name implies, the effects of water shortages can be social or economic. Distinctions between the two are both semantic and analytical in nature – more so analytic in the sense that social impacts are harder to quantify. Nevertheless, social effects associated with drought and water shortages are closely tied to economic impacts. For example, they might include:

- demographic effects such as changes in population,
- disruptions in institutional settings including activity in schools and government,
- conflicts between water users such as farmers and urban consumers,
- health-related low-flow problems (e.g., cross-connection contamination, diminished sewage flows, increased pollutant concentrations),
- mental and physical stress (e.g., anxiety, depression, domestic violence),
- public safety issues from forest and range fires and reduced fire fighting capability,
- increased disease caused by wildlife concentrations,
- loss of aesthetic and property values, and
- reduced recreational opportunities.[20]

[19] Today, most utilities participate in large interstate "power pools" and can buy or sell electricity "on the grid" from other utilities or power marketers. Thus, assuming power was available to buy, and assuming that no contractual or physical limitations were in place such as transmission constraints; utilities could offset lost power that resulted from waters shortages with purchases via the power grid.

[20] Based on information from the website of the National Drought Mitigation Center at the University of Nebraska Lincoln. Available online at: http://www.drought.unl.edu/risk/impacts.htm. See also, Vanclay, F. "*Social Impact Assessment*." in Petts, J. (ed) International Handbook of Environmental Impact Assessment. 1999.

Social impacts measured in this study focus strictly on demographic effects including changes in population and school enrollment. Methods are based on demographic projection models developed by the Texas State Data Center and used by the TWDB for state and regional water planning. Basically, the social impact model uses results from the economic component of the study and assesses how changes in labor demand would affect migration patterns in a region. Declines in labor demand as measured using adjusted IMPLAN data are assumed to affect net economic migration in a given regional water planning area. Employment losses are adjusted to reflect the notion that some people would not relocate but would seek employment in the region and/or public assistance and wait for conditions to improve. Changes in school enrollment are simply the proportion of lost population between the ages of 5 and 17.

2. Results

Section 2 presents the results of the analysis at the regional level. Included are baseline economic data for each water use category, and estimated economics impacts of water shortages for water user groups with reported deficits. According to the 2011 *Region B Regional Water Plan*, during severe drought irrigation, municipal, mining and steam-electric water user groups would experience water shortages in the absence of new water management strategies.

2.1 Overview of Regional Economy

On an annual basis, the Region B economy generates slightly more than $6.7 billion in gross state product for Texas ($6.3 billion in income and $4 million in state and local business taxes) and supports nearly 105,760 jobs (Table 8). Generating nearly $2.1 billion in gross state product manufacturing and mining are the primary base economic sector in the region.[21] Municipal sectors also generate substantial amounts of activity, and are major employers in the region. However, while municipal sectors are the largest employer and source of wealth, many businesses that make up the municipal category such as restaurants and retail stores are non-basic industries meaning they exist to provide services to people who work would in base industries such as manufacturing. In other words, without base industries many municipal jobs would not exist.

[21] Base industries are those that supply markets outside of a region. These industries are crucial to the local economy and are called the economic base of a region. Appendix A shows how IMPLAN's 529 sectors were allocated to water use category, and shows economic data for each sector.

Table 8: The Region B Economy by Water User Group ($millions)[a]						
Water Use Category	Total sales	Intermediate sales	Final sales	Jobs	Income	Business taxes
Irrigation	$27.02	$11.40	$15.60	1,218	$14.31	$0.47
Livestock	$833.33	$402.18	$431.15	7,082	$126.17	$11.00
Manufacturing	$3,811.44	$1,142.30	$2,669.14	13,556	$1,043.92	$22.20
Mining	$1,831.15	$1,142.51	$688.65	3,342	$968.54	$99.17
Steam-electric	$112.51	$31.65	$80.86	268	$78.11	$13.35
Municipal	$6,454.63	$1,391.58	$5,063.05	80,295	$4,031.66	$305.56
Regional total	$13,070.08	$4,121.62	$8,948.45	105,761	$6,262.71	$451.75

[a] Appendix 1 displays data for individual IMPLAN sectors that make up each water use category.

Source: Based on data from the Texas Water Development Board, and year 2006 data from the Minnesota IMPLAN Group, Inc.

2.2 Impacts of Agricultural Water Shortages

Irrigation

According to the 2011 *Region B Regional Water Plan*, during severe drought the counties of Archer, Clay and Wichita would experiences shortages of irrigation water without new water management strategies. Shortages of these magnitudes would reduce gross state product (income plus state and local business taxes) by an estimated $5 million in 2010 and $6 million in 2060 with potential job losses ranging from 85 to 108 (Table 9).

Table 9: Economic Impacts of Water Shortages for Irrigation Water User Groups ($millions)			
Decade	Lost income from reduced crop production*	Lost state and local tax revenues from reduced crop production	Lost jobs from reduced crop production
2010	$4.62	$0.28	85
2020	$4.82	$0.29	88
2030	$5.02	$0.31	92
2040	$5.22	$0.32	96
2050	$5.42	$0.33	100
2060	$5.87	$0.36	108

*Changes to Income and business taxes are collectively equivalent to a decrease in gross state product, which is analogous to gross domestic product measured at the state rather than national level. Appendix 2 shows results by water user group.

2.3 Impacts of Municipal Water Shortages

In the absence of water management strategies, water shortages are projected to occur for County-other water consumers in Archer, Clay and Montague counties. At the regional level, the estimated economic value of domestic water shortages totals $0.68 million in 2010 and $1.77 million in 2060 (Table 10). Since County-other is primarily self-supplied and rural we do not expect that these shortages would impact commercial business operation.

Table 10: Economic Impacts of Water Shortages for Municipal Water User Groups ($millions)

Decade	Monetary value of domestic water shortages	Lost income from reduced commercial business activity	Lost state and local taxes from reduced commercial business activity	Lost jobs from reduced commercial business activity	Lost water utility revenues
County-other (Archer)					
2010	$0.34	$0.00	$0.00	0	$0.00
2020	$1.35	$0.00	$0.00	0	$0.00
2030	$1.46	$0.00	$0.00	0	$0.00
2040	$1.54	$0.00	$0.00	0	$0.00
2050	$1.40	$0.00	$0.00	0	$0.00
2060	$1.39	$0.00	$0.00	0	$0.00
County-other (Clay)					
2010	$0.05	$0.00	$0.00	0	$0.00
2020	$0.03	$0.00	$0.00	0	$0.00
2030	$0.02	$0.00	$0.00	0	$0.00
2040	$0.01	$0.00	$0.00	0	$0.00
2050	$0.00	$0.00	$0.00	0	$0.00
2060	$0.00	$0.00	$0.00	0	$0.00
County-other (Montague)					
2010	$0.29	$0.00	$0.00	0	$0.00
2020	$0.36	$0.00	$0.00	0	$0.00
2030	$0.38	$0.00	$0.00	0	$0.00
2040	$0.39	$0.00	$0.00	0	$0.00
2050	$0.37	$0.00	$0.00	0	$0.00
2060	$0.38	$0.00	$0.00	0	$0.00
Regional Total					
2010	$0.68	$0.00	$0.00	0	$0.00
2020	$1.73	$0.00	$0.00	0	$0.00
2030	$1.86	$0.00	$0.00	0	$0.00
2040	$1.94	$0.00	$0.00	0	$0.00
2050	$1.77	$0.00	$0.00	0	$0.00
2060	$1.77	$0.00	$0.00	0	$0.00

[a] Changes to Income and business taxes are collectively equivalent to a decrease in gross state product, which is analogous to gross domestic product measured at the state rather than national level.

2.4 Impacts of Mining Water Shortages

Mining water shortages are projected to occur in Montague County, and would reduce gross state product by roughly $2 million in each decade (Table 11).

Table 11: Economic Impacts of Water Shortages for Mining Water User Groups ($millions)			
Decade	Lost income due to reduced mining output	Lost state and local business tax revenues due to reduced mining output	Lost jobs due to reduced mining output
2010	$1.81	$0.18	11
2020	$1.62	$0.16	9
2030	$1.55	$0.15	9
2040	$1.59	$0.16	9
2050	$1.69	$0.17	10
2060	$1.69	$0.17	10

*Changes to Income and business taxes are collectively equivalent to a decrease in gross state product, which is analogous to gross domestic product measured at the state rather than national level. Appendix 2 shows results by water user group.

2.5 Impacts of Steam-electric Water Shortages

Water shortages for steam-electric are projected to occur in Wilbarger County, and would reduce gross state product by $142 million dollars in 2020, and $801 million 2060 (Table 12).

Table 12: Economic Impacts of Water Shortages for Steam-electric Water User Groups ($millions)			
Decade	Lost income due to reduced electrical generation	Lost state and local business tax revenues due to reduced electrical generation	Lost jobs due to reduced electrical generation
2010	$0.00	$0.00	0
2020	$124.64	$17.89	424
2030	$279.75	$40.15	951
2040	$303.66	$43.59	1,032
2050	$327.57	$47.02	1,114
2060	$702.90	$100.89	1,195

*Changes to Income and business taxes are collectively equivalent to a decrease in gross state product, which is analogous to gross domestic product measured at the state rather than national level.

2.6 Social Impacts of Water Shortages

As discussed previously, estimated social impacts focus on changes in population and school enrollment. In 2010, estimated population losses total 13 people with corresponding reductions in school enrollment of 4 students (Table 13). In 2060, population in the region would decline by 1,451 people and school enrollment would fall by 412 students.

Table 13: Social Impacts of Water Shortages (2010-2060)

Year	Population Losses	Declines in School Enrollment
2010	13	4
2020	522	148
2030	1,156	328
2040	1,254	356
2050	1,354	384
2060	1,451	412

2.7 Distribution of Impacts by Major River Basin

Administrative rules require that impacts are presented by both planning region and major river basin. To meet rule requirements, impacts were allocated among basins based on the distribution of water shortages in relevant basins. For example, if 50 percent of water shortages in River Basin A and 50 percent occur in River Basin B, then impacts were split equally among the two basins. Table 14 displays the results.

Table 14: Distribution of Impacts by Major River Basin (2010-2060)

Water Use	2010	2020	2030	2040	2050	2060
Irrigation						
Red	100%	100%	100%	100%	100%	100%
Mining						
Red	94%	93%	93%	93%	93%	93%
Trinity	6%	7%	7%	7%	7%	7%
Municipal						
Brazos	21%	19%	19%	20%	19%	19%
Red	31%	31%	31%	31%	31%	31%
Trinity	48%	50%	50%	49%	50%	50%
Steam-electric						
Red	0%	100%	100%	100%	100%	100%

Appendix 1: Economic Data for Individual IMPLAN Sectors

Economic Data for Agricultural Water User Groups ($millions)									
Water Use Category	**IMPLAN Sector**	**IMPLAN Code**	**Total Sales**	**Intermediate Sales**	**Final Sales**	**Jobs**	**Income**	**Business Taxes**
Irrigation	All “Other” Crop Farming	5	$11.87	$10.97	$0.79	953	$5.80	$0.23
Irrigation	Cotton Farming	5	$4.11	$0.06	$4.10	42	$1.52	$0.04
Irrigation	Fruit Farming	4	$4.79	$0.13	$4.66	113	$2.79	$0.11
Irrigation	Grain Farming	5	$1.18	$0.10	$1.12	37	$0.54	$0.02
Irrigation	Tree Nut Farming	6	$1.35	$0.04	$1.32	23	$0.92	$0.03
Irrigation	Vegetable and Melon Farming	7	$3.71	$0.10	$3.61	50	$2.74	$0.04
Irrigation	**Total**	**na**	**$27.02**	**$11.40**	**$15.60**	**1,218**	**$14.31**	**$0.47**
Livestock	Meat processed from carcasses	68	$371.43	$109.58	$261.85	852	$39.23	$2.01
Livestock	Cattle ranching and farming	11	$326.53	$226.42	$100.12	4,089	$25.80	$6.86
Livestock	Animal production- except cattle and poultry	13	$8.29	$7.03	$1.26	218	$0.81	$0.13
Livestock	Animal- except poultry- slaughtering	67	$3.62	$0.97	$2.65	8	$0.55	$0.02
Livestock	Other animal food manufacturing	47	$3.14	$0.38	$2.76	4	$0.20	$0.02
Livestock	Poultry and egg production	12	$2.69	$2.11	$0.58	7	$0.91	$0.01
Livestock	**Total**	**na**	**$715.70**	**$346.47**	**$369.22**	**5,178**	**$67.50**	**$9.05**
	Total agriculture	**na**	**$833.33**	**$402.18**	**$431.15**	**7,082**	**$126.17**	**$11.00**

Based on year 2006 data from the Minnesota IMPLAN Group, Inc.

Economic Data for Mining and Steam-electric Water User Groups ($millions)								
Water Use Category	**IMPLAN Sector**	**IMPLAN Code**	**Total Sales**	**Intermediate Sales**	**Final Sales**	**Jobs**	**Income**	**Business Taxes**
Mining	Oil and gas extraction	19	$1,203.01	$1,117.22	$85.79	1,742	$690.21	$74.72
Mining	Drilling oil and gas wells	27	$454.08	$2.27	$451.82	729	$130.87	$17.26
Mining	Support activities for oil and gas operations	28	$140.93	$19.57	$121.36	811	$127.64	$5.92
Mining	Sand- gravel- clay- and refractory mining	25	$32.59	$3.44	$29.15	56	$19.64	$1.25
Mining	**Support activities for other mining**	29	$0.55	$0.01	$0.54	4	$0.18	$0.02
Mining	**Total mining**	**na**	**$1,831.15**	**$1,142.51**	**$688.65**	**3,342**	**$968.54**	**$99.17**
Steam-electric	**Power generation and supply**	**na**	**$112.51**	**$31.65**	**$80.86**	**268**	**$78.11**	**$13.35**
Based on year 2006 data from the Minnesota IMPLAN Group, Inc.								

Economic Data for Manufacturing Water User Groups ($millions)								
Water Use Category	**IMPLAN Sector**	**IMPLAN Code**	**Total Sales**	**Intermediate Sales**	**Final Sales**	**Jobs**	**Income**	**Business Taxes**
Manufacturing	Petrochemical manufacturing	147	$864.60	$396.13	$468.47	109	$80.62	$4.58
Manufacturing	Aircraft engine and engine parts manufacturing	352	$634.58	$173.88	$460.70	1,680	$130.71	$1.84
Manufacturing	Glass and glass products- except glass containers	190	$380.65	$238.61	$142.04	1,412	$180.24	$3.91
Manufacturing	Plastics pipe- fittings- and profile shapes	173	$278.10	$171.06	$107.04	725	$87.94	$1.98
Manufacturing	New residential 1-unit structures- all	33	$183.48	$0.00	$183.48	1,298	$55.90	$0.88
Manufacturing	Gypsum product manufacturing	197	$133.79	$0.47	$133.33	245	$40.73	$1.22
Manufacturing	Commercial and institutional buildings	38	$99.85	$0.00	$99.84	1,131	$47.83	$0.59
Manufacturing	Footwear manufacturing	110	$70.06	$0.58	$69.48	640	$16.49	$0.38
Manufacturing	Sheet metal work manufacturing	236	$66.77	$3.64	$63.13	423	$21.62	$0.29
Manufacturing	Relay and industrial control manufacturing	336	$55.91	$8.14	$47.77	194	$19.99	$0.52
Manufacturing	Metal tank- heavy gauge- manufacturing	239	$52.78	$2.17	$50.61	276	$19.95	$0.28
Manufacturing	Power boiler and heat exchanger manufacturing	238	$52.70	$0.90	$51.80	208	$22.97	$0.30
Manufacturing	Motor vehicle parts manufacturing	350	$48.92	$3.93	$44.98	109	$17.94	$0.28
Manufacturing	Manufactured home- mobile home- manufacturing	121	$43.60	$0.00	$43.60	300	$15.35	$0.19
Manufacturing	Other new construction	41	$43.32	$0.00	$43.32	520	$22.19	$0.17
Manufacturing	AC- refrigeration- and forced air heating	278	$43.04	$0.00	$43.04	143	$7.80	$0.19
Manufacturing	Foam product manufacturing	178	$39.59	$30.14	$9.44	146	$13.15	$0.27
Manufacturing	Other rubber product manufacturing	181	$38.66	$1.00	$37.66	146	$17.36	$0.32
Manufacturing	Truck trailer manufacturing	347	$36.99	$0.81	$36.18	115	$12.52	$0.22
Manufacturing	Automatic vending- commercial laundry and dry	274	$36.76	$13.68	$23.08	160	$10.99	$0.20
Manufacturing	Aluminum extruded product manufacturing	212	$36.33	$0.92	$35.41	118	$5.80	$0.22
Manufacturing	Speed changers and mechanical power transmission	287	$30.55	$15.89	$14.65	141	$12.57	$0.13
Manufacturing	Ready-mix concrete manufacturing	192	$29.87	$0.15	$29.72	114	$8.89	$0.22
Manufacturing	Machine shops	243	$29.82	$7.20	$22.63	239	$12.59	$0.20
Manufacturing	Oil and gas field machinery and equipment	261	$27.38	$1.02	$26.36	86	$4.19	$0.09
Manufacturing	Fabricated structural metal manufacturing	233	$26.99	$1.40	$25.59	111	$8.79	$0.14
Manufacturing	**All other manufacturing**		**$426.37**	**$70.57**	**$355.79**	**2,767**	**$148.80**	**$2.60**
	Total manufacturing	**NA**	**$3,811.44**	**$1,142.30**	**$2,669.14**	**13,556**	**$1,043.92**	**$22.20**
Based on year 2006 data from the Minnesota IMPLAN Group, Inc.								

Economic Data for Municipal Water User Groups ($millions)

Water Use Category	IMPLAN Sector	IMPLAN Code	Total Sales	Intermediate Sales	Final Sales	Jobs	Income	Business Taxes
Municipal	Owner-occupied dwellings	509	$585.17	$0.00	$585.17	0	$453.31	$69.19
Municipal	Federal Military	505	$539.09	$0.00	$539.09	6,170	$539.09	$0.00
Municipal	State & Local Education	503	$399.79	$0.00	$399.79	10,627	$399.79	$0.00
Municipal	Wholesale trade	390	$295.91	$141.67	$154.24	2,336	$155.85	$43.71
Municipal	Hospitals	467	$285.36	$0.00	$285.36	2,549	$150.07	$1.92
Municipal	Offices of physicians- dentists- and other he	465	$276.73	$0.00	$276.73	2,798	$192.96	$1.70
Municipal	Telecommunications	422	$268.62	$92.27	$176.36	1,064	$93.85	$15.56
Municipal	Food services and drinking places	481	$266.64	$34.05	$232.59	5,916	$103.56	$12.09
Municipal	Monetary authorities and depository credit in	430	$240.79	$79.31	$161.48	1,287	$169.09	$3.08
Municipal	State & Local Non-Education	504	$239.44	$0.00	$239.44	4,644	$239.44	$0.00
Municipal	Real estate	431	$157.14	$62.21	$94.94	1,029	$90.91	$19.37
Municipal	Motor vehicle and parts dealers	401	$155.35	$16.89	$138.46	1,501	$79.89	$22.63
Municipal	General merchandise stores	410	$143.50	$15.12	$128.38	2,721	$63.75	$20.34
Municipal	Truck transportation	394	$137.66	$74.54	$63.12	1,083	$61.72	$1.40
Municipal	Other State and local government enterprises	499	$127.59	$41.55	$86.05	645	$43.32	$0.02
Municipal	Other ambulatory health care services	466	$92.82	$6.04	$86.78	624	$46.43	$0.69
Municipal	Automotive equipment rental and leasing	432	$84.78	$34.67	$50.11	619	$26.81	$1.42
Municipal	Food and beverage stores	405	$82.91	$11.09	$71.83	1,656	$40.81	$8.92
Municipal	Nursing and residential care facilities	468	$80.94	$0.00	$80.94	1,954	$47.37	$1.11
Municipal	Architectural and engineering services	439	$75.93	$47.86	$28.06	539	$43.85	$0.36
Municipal	Civic- social- professional and similar organ	493	$69.53	$24.43	$45.10	2,186	$31.77	$0.20
Municipal	Insurance carriers	427	$68.32	$19.92	$48.40	317	$20.40	$2.51
Municipal	Insurance agencies- brokerages- and related	428	$68.18	$40.01	$28.17	804	$57.81	$0.38
Municipal	Automotive repair and maintenance- except car	483	$68.12	$16.18	$51.94	1,019	$22.81	$4.59
Municipal	Postal service	398	$66.20	$45.07	$21.13	795	$54.96	$0.00
Municipal	All other municipal		$1,512.72	$578.57	$934.15	$24,682.00	$770.90	$64.88
	Total municipal	**NA**	$6,454.63	$1,391.58	$5,063.05	80,295	$4,031.66	$305.56

Based on year 2006 data from the Minnesota IMPLAN Group, Inc.

ATTACHMENT 4-4

REGIONAL WATER PLANNING GROUP B

EXECUTIVE SUMMARY

WICHITA COUNTY WATER IMPROVEMENT DISTRICT NO. 2

WATER CONSERVATION IMPLEMENTATION PLAN

EXECUTIVE SUMMARY

WICHITA COUNTY WATER IMPROVEMENT DISTRICT NO. 2
WATER CONSERVATION IMPLEMENTATION PLAN

INTRODUCTION

The purpose of this project is to facilitate the implementation of recommendations in the Region B Regional Water Plan (January 2006) (Region B Plan) with respect to meeting the irrigation needs in the region by evaluating the Wichita County Water Improvement District No. 2 (WCWID No. 2 or District) conveyance system and developing a Water Conservation Implementation Plan. The Region B Plan concluded that a shortage of irrigation water supply of 275 acre-feet per year may occur as early as 2010 increasing to 25,460 acre-feet per year by 2060. The recommendation adopted in the Region B Plan is to develop 8,577 acre-feet per year through water conservation achieved by enclosing laterals in pipe by 2040.

GOALS AND REPORT STRUCTURE

The goals for this study as identified in the scope of work are listed below along with the chapter of the report where each is addressed.

- Identify and Evaluate Candidate Laterals and Establish Criteria and Methods for the Implementation Plan (Chapter 2).
- Prepare Maps of Selected Laterals (Chapter 3).
- Estimate Potential Water Savings (Chapter 4) – by applying the procedures for estimating water savings previously developed.
- Prepare Preliminary Opinions of Cost (Chapter 5) – develop preliminary opinions of cost for design and construction of improvements.
- Document Other Relevant Factors (Chapter 6) – identification of factors that impact the priority for implementation of projects.
- Identify Potential Sources of Funding for the Project to Pipe Laterals (Chapter 7) – evaluate state and federal funding opportunities.
- Prepare Water Conservation Implementation Plan (Chapter 8) – develop a plan of action for converting earthen laterals to pipelines, including consideration of project ranking, available funding, and other factors.

IDENTIFICATION OF CANDIDATE LATERALS

The WCWID No. 2 facilities consist of over 40 laterals supplied by the South Side Canal, North Side Canal or Call Field Canal. The WCWID No. 2 identified, based on experience operating the system, 10 priority laterals known to have higher water loss (Figure ES-1). These laterals were the initial focus of the evaluation. The WCWID No. 2 staff identified the laterals in two groups (Table ES-1), indicating that Group 1 (first 5 laterals) were estimated to have potentially greater water loss than Group 2 (second 5 laterals). However, no water loss measurements had been made by the District to confirm the relative magnitude of the losses. Field water measurement studies were performed on 5 of the laterals (Group 1) by a team composed of staff from the District, Red River Authority of Texas (RRA-TX), and Alan Plummer Associates, Inc. (APAI).

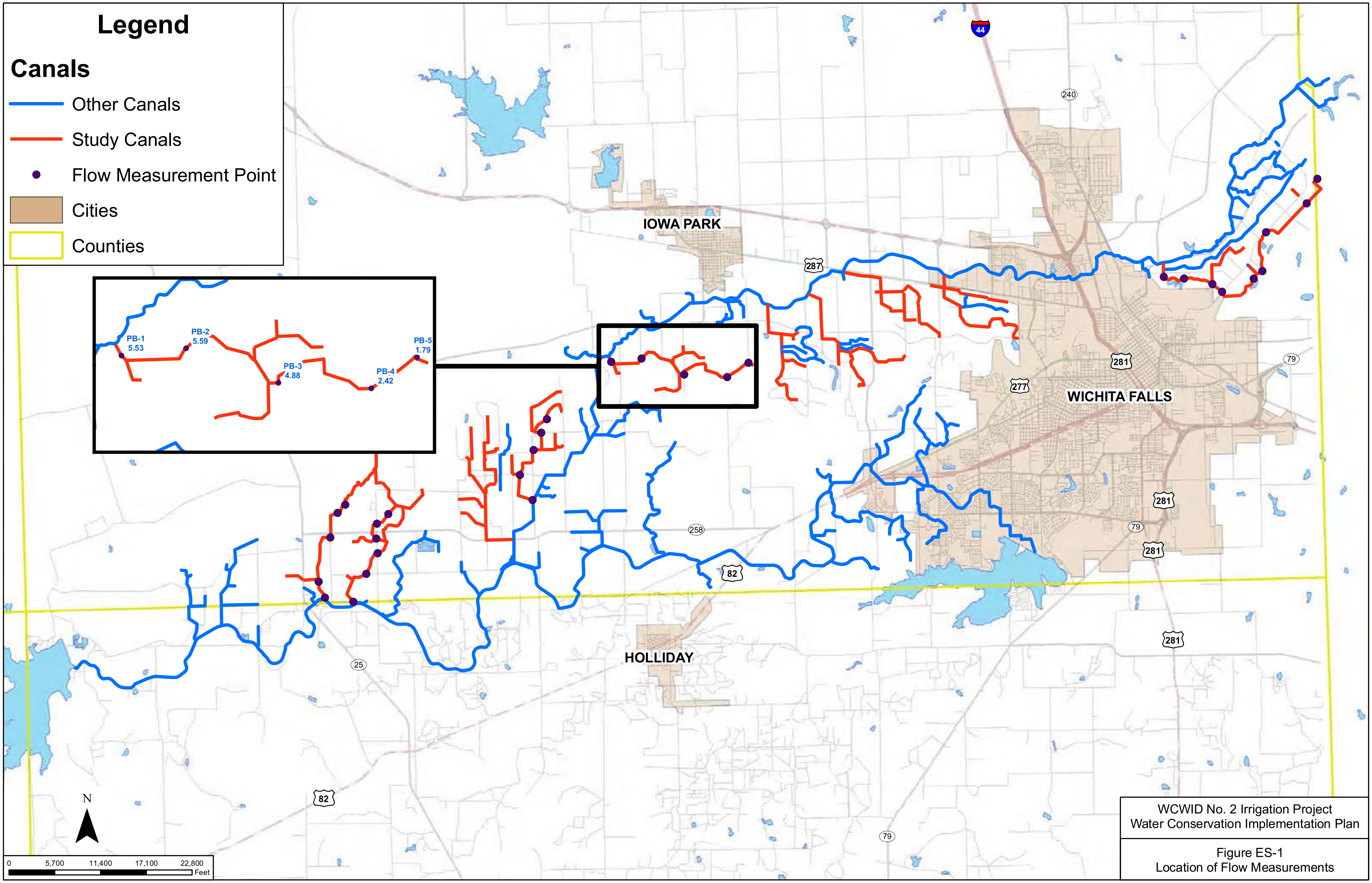
Table ES-1
WCWID No. 2
Water Conservation Implementation Plan

Laterals with the Greatest Apparent Water Losses

Group 1—High Loss Laterals Flow Measurements	Group 2 – High Loss Laterals No Flow Measurements
SJ	NB
SK	PM
NF	PO
PB	RR
WJ	RRG

Flow Measurement Technique

A direct inflow-outflow measurement technique was applied to assess losses within each segment. This method includes flow measurement at the upstream and downstream ends of a lateral segment with the losses in the segment being the difference between the two flow measurements. This method was selected over indirect methods or other direct methods such as ponding tests that may be more accurate but would have required significantly more construction/setup effort and interruption of district operations. The flow measurement locations are also identified on Figure ES-1.



WCWID No. 2 Irrigation Project
Water Conservation Implementation Plan

Figure ES-1
Location of Flow Measurements

Table ES-2
WCWID No. 2
Water Conservation Implementation Plan

Flow Measurements

Flow Measurement Station	Flow (cfs)	Flow Measurement Station	Flow (cfs)
SJ-1	6.1	PB-1	5.5
SJ-2	6.3	PB-2	5.5
SJ-3	5.7	PB-3	4.8
SJ-4	2.3	PB-4	2.4
SJ-5	Spill—No meas.	PB-5	1.8
SK-1	10.1	WJ-1	10.2
SK-2	10.2	WJ-2	12.0
SK-3	9.04	WJ-3	10.6
SK-4	8.6	WJ-4	9.75
SK-5	8.1	WJ-5	8.76
SK-6	8.3	WJ-6	8.44
NF-1	12.4	WJ-7	7.88
NF-2	7.3	WJ-8	7.34
NF-3	4.4	WJ-9	9.82
NF-4	4.3		
NF-5	4.2		

It is clear from reviewing the data in Table ES-2 that some lateral segments have significantly greater loss than other segments. The challenge is in determining the factors that contribute to these differences in seepage loss across the system. If the factors that contribute to seepage loss can be evaluated and a relationship developed, then these same factors can be applied in evaluating seepage losses in other laterals.

Methods for Assessment of Laterals

Many factors were evaluated to assess potential seepage loss within each lateral segment. These included:

- Lateral cross section—shape relative to the original design cross section.
- Lateral condition—stability and condition of the bottom and side slopes.

- Soil type—textural classification and permeability.
- Underlying geology—contributes to the permeability.
- Vegetation size and density—contributing to degradation of lateral side slopes and creates highly porous zones.

Based on the data available for evaluation of the WCWID No. 2 and consideration of the methods others have used for assessment of seepage loss from laterals, three factors were identified as having the greatest effect on seepage loss—soil type and permeability, lateral condition, and vegetation condition. Measurement and evaluation parameters were developed for each of these factors. A soil factor ranging from 0.05 to 3.0 was related to each of the different soil types based on subsoil permeability. A lateral vegetation factor (1 through 5) was based on the size and density of vegetation along the laterals, and a lateral condition factor (0.5 through 1.5) was based on the condition of the bottom, side slopes, and embankment along the lateral.

Correlation of Lateral Condition to Water Loss

The objective of performing a correlation between the lateral conditions and water loss is to demonstrate a method that can be used to assess water loss in the five Group 2 laterals where flow was not measured. Further, demonstration of this method for the Group 2 laterals can then establish an approach that the WCWID No. 2 can use to assess water loss in other laterals.

The soil, vegetation, and lateral condition factors were combined to develop a combined soil-condition factor for each segment/subsegment of lateral. The water losses were distributed according to this factor and correlated to develop a relationship between water loss and the soil-condition factor. The resulting relationship produced the equation:

$$\text{Water Loss (cfs/1,000 ft)} = 0.1046\ x^{0.9039}$$

Where: x = the Soil-Condition Factor

This equation was applied to estimate water loss in the 5 laterals where flow measurements were not taken.

PREPARE GIS MAPS OF SELECTED LATERALS

GIS maps were developed for the entire WCWID No. 2 system. Initial maps were developed from base maps provided by the RRA-TX. These maps were updated based on aerial photography obtained from the U. S. Department of Agriculture (USDA) Farm Service Agency (FSA). Lateral alignments were adjusted to coincide with the alignments shown on the aerial photos and WCWID No. 2 staff assisted in identifying changes in the designation of the lateral materials to reflect current conditions. The District staff also assisted the team by performing the evaluation of the lateral segments and classifying the vegetation and lateral condition for all 10 priority laterals. In addition, the GIS was updated to provide for capture of the following information:

- Lateral Data.
    - Flow Measurements.
    - Lateral Material.
    - Irrigated acreages.
    - Soils.
    - Turnout locations.
    - Vegetation Condition.
    - Lateral Condition.

- Turnout Data
    - Irrigated acreage served by the turnout.
    - Type of turnout.
    - Size of turnout.

- Parcel boundary and Texas Land Survey Abstract names.

ESTIMATE OF POTENTIAL WATER SAVINGS

The water loss equation was applied along with the information collected in the map development effort to estimate water loss by subsegment for the five laterals in Group 2: NB, PM, PO, RR, and RRG. This information was combined with the assessment of water loss by subsegment for the five laterals in Group 1 and evaluated for total water loss by segment and unit water loss (cfs/1,000 ft) for the entire irrigation season. The “high-water-loss segments” were considered as being segments with total season losses greater than 100 acre-feet per 1,000 feet of lateral or 300 acre-feet per lateral segment for the entire season. The segments and laterals classified as high-water-loss are shown in Table ES-3. It should be noted that lateral PM that was initially included in the group of ten priority laterals, was identified as having marginally high-water-loss, and may be considered for inclusion depending upon funding and future project objectives. The total water savings that could be achieved by converting all of these segments to pipelines is estimated at 13,034 acre-feet per year, which exceeds the target of 8,577 acre-feet per year, but is about half of the projected 2060 shortage of 25,460 acre-feet per year.

PRELIMINARY OPINION OF COST

Cost estimates were developed for conversion of each of the lateral segments included in Table ES-3 to underground pipe systems. Costs were developed based on conversion of all high-water-loss segments of the lateral to pipeline in a single project. This avoids piece-meal construction across the District, which could significantly increase project costs. Table ES-4 provides the summary of the capital and annualized costs for each of the lateral segments included in the evaluation, and the cost savings per acre-foot of water saved as a result of the proposed conversion.

Table ES-3
WCWID No. 2
Water Conservation Implementation Plan

High Water Loss Segments

Lateral Name	Segment			Length	Season Loss per 1,000 ft (ac-ft/1,000 ft)	Season Water Loss (ac-ft/yr)
NF	0	-	1,550	1,550	394	611
NF	1,550	-	2,050	500	412	206
NF	2,050	-	4,350	2,300	296	680
NF	4,350	-	5,950	1,600	201	322
NF	5,950	-	7,150	1,200	122	147
NF	7,150	-	8,700	1,550	302	467
NF	8,700	-	8,850	150	288	446
NF	12,025	-	15,225	3,200	151	483
PB	15,450	-	15,950	500	120	153
PB	15,950	-	18,050	2,100	110	231
PB	20,450	-	21,300	850	525	446
SJ	8,650	-	9,375	725	288	209
SJ	9,375	-	12,175	2,800	288	807
SJ	12,850	-	13,800	950	470	446
SK	4,800	-	7,850	3,050	113	344
SK	13,675	-	15,625	1,950	229	446

Table ES-3
WCWID No. 2
Water Conservation Implementation Plan

High Water Loss Segments

Lateral Name	Segment			Length	Season Loss per 1,000 ft (ac-ft/1,000 ft)	Season Water Loss (ac-ft/yr)
WJ	2,825	-	3,825	1,000	279	279
WJ	6,075	-	7,675	1,600	153	245
WJ	24,900	-	29,025	4,125	108	446
RR	2,380	-	6,100	3,720	109	405
RR	9,150		12,950	3,800	109	414
RR	15,000		17,700	2,700	37	545
PO	0	-	530	530	126	67
PO	530	-	5,940	5,410	76	413
PO	5,940	-	8,860	2,920	157	459
PO	10,310	-	16,880	6,570	7	494
RRG	5,000	-	5,275	275	109	30
RRG	7,385	-	15,295	7,910	109	862
RRG	15,295	-	17,415	2,120	157	780
NB	0	-	9,200	9,200	31	286
NB	9,200	-	12,250	3,050	109	332
NB	17,750	-	18,900	1,150	76	534
Total				**81,055**		**13,034**

Table ES-4
WCWID No. 2
Water Conservation Implementation Plan

Summary of Lateral Conversion Cost

Lateral	Pipe Diameter (in)	Length (ft)	Total Supply (ac-ft/yr)	Capital Cost (Thousands $)	Total Annual Cost ($)	Unit Cost ($/ac-ft)
NF	27-46	12,050	3,362	1,470	129,446	38.51
PB	27	3,450	830	359	31,595	38.07
SJ	24-27	4,475	1,462	426	37,547	25.68
SK	27-30	5,000	790	560	49,281	62.37
WJ	24-30	6,725	970	653	57,489	59.28
RR	18	10,220	1,364	465	40,924	30.00
PO	18-24	15,430	1,433	1,299	114,390	79.83
RRG	24	10,305	1,672	965	84,935	50.80
NB	15, 27-30	13,400	1,152	1,462	128,771	111.78
Total		**81,055**	**13,034**	**7,658**	**674,377**	**51.74**

OTHER RELEVANT FACTORS CONSIDERED

Two factors were identified in addition to the unit cost of conserved water that may be worthy of consideration in prioritizing the laterals to convert to pipelines. These factors included the degree of urbanization and the frequency of use per lateral. The urbanization factor was evaluated as reducing the priority for conversion if the area served is being urbanized or converted to rural subdivisions indicating a declining need for irrigation water. Conversely, if the area served is not converting to urban land use but the lateral flows through an urbanized area, then this was viewed as increasing the priority for conversion by reducing risk. The frequency of use factor was evaluated by the District as positively impacting operations and affecting water savings. The District ranked the nine high-water-loss laterals on frequency of use from 1 to 9, with 1 representing the most frequently used and 9 representing the least frequently used lateral.

POTENTIAL SOURCES OF FUNDING

Three funding sources were evaluated to identify options that may be used to fund the $7,700,000 of proposed improvements to convert high-loss-lateral segments to pipelines. These sources included:

- WCWID No. 2 and other local funds.
- State Funding Programs.
- Federal Funding Programs.

WCWID No. 2 Funds

WCWID No. 2 derives about $250,000 per year of total operating revenue from the District tax. Other district revenues are set by long term contracts and are not a viable source for increasing additional revenue. Tax increases of 3 percent each of the last two years have resulted in the district having about $20,000 to $30,000 per year available for use in implementing improvements as a result of other budget savings. The District has installed about 2,000 feet of pipe with these funds using District forces. Each 3 percent increase in the tax rate increases District revenue by about $6,000. Conversion of just over 15 miles of lateral to pipeline would reduce maintenance costs saving the District about $26,000 per year. Therefore, total funds available for improvements are estimated to be from $46,000 to $56,000 per year without further tax increases.

State Funding Programs

There are two programs that may be available to assist the District in funding the local share of the costs for improvements: the Agricultural Water Conservation Loan Program (AWCLP) and the Water Infrastructure Fund (WIF). Both of these programs have subsidized loan rates that are at least 2 percent below the Texas Water Development Board's (TWDB's) standard loan rate, which is less than market loan rates. Loan rates for these programs vary over time. The October, 2008, loan rates were 1.66 percent for the AWCLP and 2.15 percent for the WIF.

The Drinking Water State Revolving Fund (DWSRF) and Clean Water State Revolving Fund (CWSRF) were evaluated. These funds are not typically used to assist irrigation districts with improvements and were not identified as a likely funding source, even though these funds will be supplemented from the American Recovery and Reinvestment Act of 2009 (ARRA).

Federal Funding Programs

The most viable option for federal funding is the Water Resources Development Act (WRDA), which is a 75 percent grant program that requires a local matching share of 25 percent. This program is administered by the TWDB as the Texas Environmental Infrastructure Program (TEIP). It is targeted for construction projects rather than for planning projects, and is focused on projects identified in the state and regional water plans. Availability of funds depends upon appropriations which may be authorized through budget appropriations or though the ARRA. The District submitted a statement of interest for the 2009 program, and the project was recommended for funding, ranking 19 of 32, so it may not be funded until after 2010.

Other Federal funding programs through the U.S. Bureau of Reclamation (USBR) the U.S. Army Corps of Engineers (USACE), and the U.S. Department of Agriculture (USDA) were evaluated, but none of the programs were specifically identified as having funds available to implement construction projects of the magnitude proposed in this study. Additional grant funds may become available through these agencies or WRDA as a result of the ARRA, and it is recommended that these funding sources continue to be monitored.

WATER CONSERVATION IMPLEMENTATION PLAN

Prioritization of Laterals for Replacement

The laterals were prioritized for replacement based a matrix of factors that include the unit cost for conserved water, the urbanization factor, and the frequency of use factor. Table ES-5 provides the priority of ranking and further divides the project into three priority groups based on ranking and total cost. A subtotal project cost target in the range of $2 to $3 million was used as the basis for dividing the priority groups shown in the table. The actual costs for each priority group of projects are expected to range from about $1.9 million to about $2.9 million. The laterals identified for each priority group are shown on Figure ES-2

Implementation Options for Lateral Replacements

The preferred option is implementation of the entire effort as a single project. This would yield the full 13,034 acre-feet per year of conservation. However, the cost may be greater than the District can support with local cooperation. Therefore, an alternative approach that treats funding each of the Priority Groups (A through C), separately in a phased project, may be a viable approach. Both project options are developed on the basis of obtaining grant funds for 75 percent of the project costs and loan funds to assist the District with local 25 percent match.

Table ES-5
WCWID No. 2 Irrigation Project
Water Conservation Implementation Plan

Priority Groups for Lateral Replacement

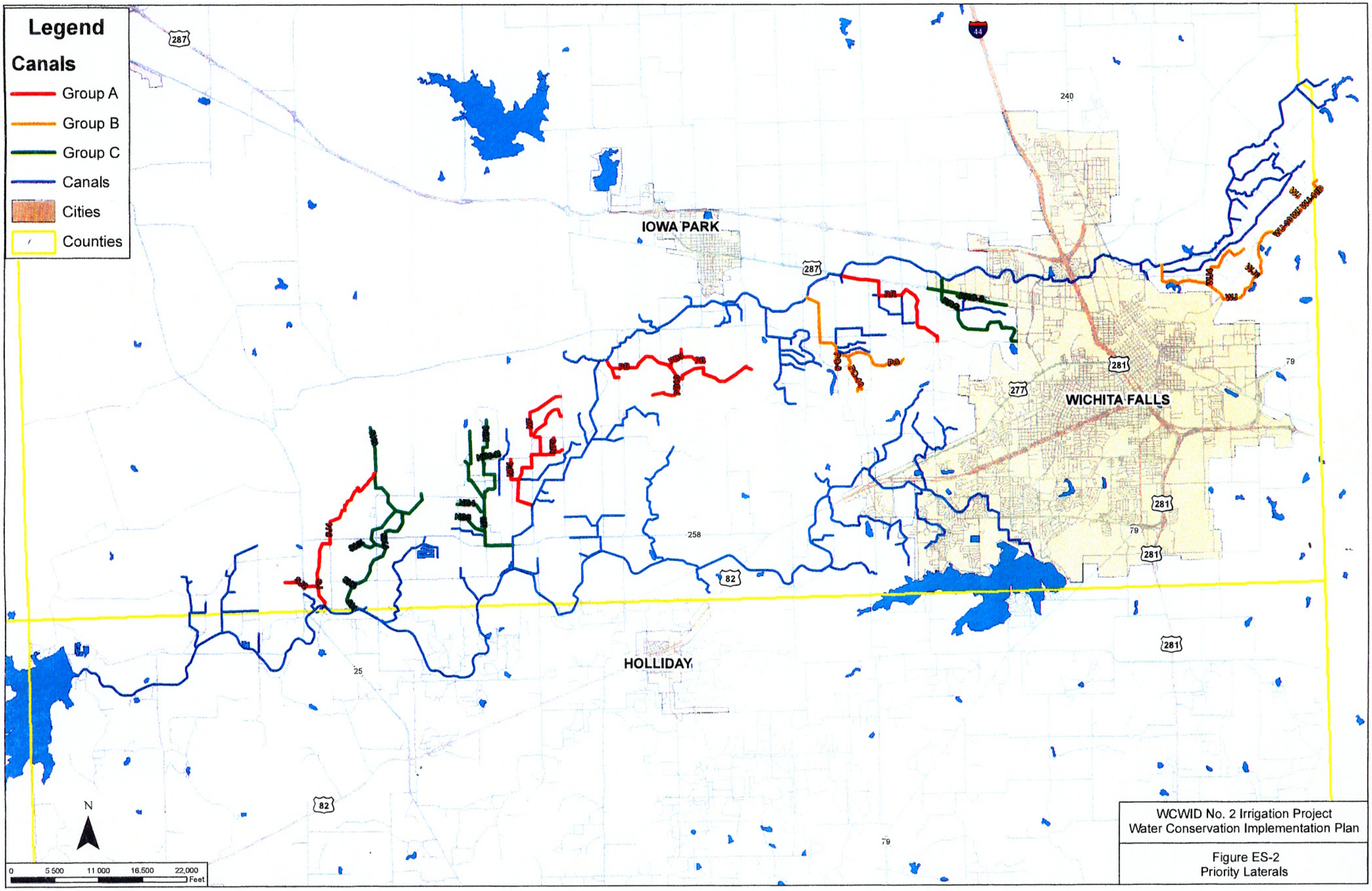
Lateral	Ranking	Supply (ac-ft/yr)	Capital Cost ($)	Annual Cost ($)	Unit Cost ($/ac-ft)
Priority Group A					
PB	1	830	358,800	31,595	38.07
SJ	2	1,462	426,400	37,547	25.68
RR	3	1,364	464,750	40,924	30.00
NF	4	3,362	1,470,040	129,446	38.51
Subtotal		***7,018***	***2,719,990***	***239,512***	***34.13***
Priority Group B					
WJ	4	970	652,860	57,489	59.28
PO	5	1,433	1,299,051	114,390	79.83
Subtotal		***2,403***	***1,951,911***	***171,879***	***71.53***
Priority Group C					
RRG	6	1,672	964,548	84,935	50.80
SK	7	790	559,650	49,281	62.37
NB	8	1,152	1,462,370	128,771	111.78
Subtotal		***3,614***	***2,986,568***	***262,987***	***72.77***
Total		**13,034**	**7,658,469**	**674,378**	**51.74**

Full Project Option

The cost to implement the full project is estimated at $7,658,469. A 75 percent grant would fund just over $5.7 million of this cost as presented in Table ES-6. A loan would cover the remaining $1.9 million. Depending upon the loan program used for the local share of the costs, and interest rate (WIF is currently 2.15% and Agricultural Water Conservation Fund (AWCF) is 1.66%), the loan payments could range from $113,000 to $119,000 per year. This exceeds the District's current annual resources of $46,000 to $56,000 that would be available for improvements with implementation of the full project. The District would need to increase its tax rate by about 33 percent to develop an additional $67,000 in revenue, if this were the sole source of funding.

Phased Project Option

An alternative to implementing the entire project at one time is to phase the project in three steps corresponding to the three priority groups identified above. This approach would require three separate funding and construction efforts staged at 10-year intervals. The cost of each phase is based on 75 percent grant funding (Table ES-6) and 25 percent local match through use of a loan program. The loan payments range from about $28,000 per year to $46,000 per year for each phase, depending upon the phase and loan program available. Annual payments would increase after the first 10-year interval and continue as shown at the bottom of Table ES-6 for two decades (2020-2039: $69,000 to $76,000 per year) and would then decrease for the last decade (2040-2049: $44,000 to $46,000), assuming all three phases are implemented.



WCWID No. 2 Irrigation Project
Water Conservation Implementation Plan

Figure ES-2
Priority Laterals

Table ES-6
WCWID No. 2, Water Conservation Implementation Plan

Project Financing Options

PROJECT OPTIONS			**Payment Period**			
Full Project Option (loan in 2009, payment begins 2010)			**2010-2019**	**2020-2029**	**2030-2039**	**2040-2049**
Full Project Cost (13,034 ac-ft/yr conservation)		**$7,658,469**				
Grant (75%)	$5,743,852					
Local Share (25%)	$1,914,617					
Annual Loan Payment (WIF option at 2.15%)		**$118,793**	$118,793	$118,793		
Annual Loan Payment (AWCF option at 1.66%)		**$113,285**	$113,285	$113,285		
Staged Project Option (by Priority Groups A-C)						
Priority Group A (loan in 2009, payment begins 2010)						
Short Term Project (7,018 ac-ft/yr conservation)		**$2,719,990**				
Grant (75%)	$2,039,993					
Local Share (25%)	$679,998					
Annual Loan Payment (WIF option at 2.15%)		**$42,191**	$42,191	$42,191		
Annual Loan Payment (AWCF option at 1.66%)		**$40,234**	$40,234	$40,234		
Priority Group B (loan in 2019, payment begins 2020)						
Short Term Project (2,403 ac-ft/yr conservation)		**$1,951,911**				
Grant (75%)	$1,463,933					
Local Share (25%)	$487,978					
Annual Loan Payment (WIF option at 2.15%)		**$30,277**		$30,277	$30,277	
Annual Loan Payment (AWCF option at 1.66%)		**$28,873**		$28,873	$28,873	
Priority Group C (loan in 2029, payment begins 2030)						
Short Term Project (3,614 ac-ft/yr conservation)		**$2,986,568**				
Grant (75%)	$2,239,926					
Local Share (25%)	$746,642					
Annual Loan Payment (WIF option at 2.15%)		**$46,326**			$46,326	$46,326
Annual Loan Payment (AWCF option at 1.66%)		**$44,178**			$44,178	$44,178
Total Annual Payments for 3 phase effort						
WIF Loan			$42,191	$72,468	$76,603	$46,326
AWCF Loan			$40,234	$69,107	$73,051	$44,178

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ATTACHMENT 4-5

REGIONAL WATER PLANNING GROUP B

SUMMARY OF POTENTIALLY FEASIBLE STRATEGIES

(RECOMMENDED & ALTERNATE)

List of Potentially Feasible Strategies
Region B

CONSTRUCT LAKE RINGGOLD
DEVELOP OTHER AQUIFER SUPPLIES
DEVELOP TRINITY AQUIFER SUPPLIES
EMERGENCY INTERCONNECT MILLERS CREEK RESERVOIR
ENCLOSE CANAL LATERALS IN PIPE
INCREASE WATER CONSERVATION POOL AT LAKE KEMP
MUNICIPAL CONSERVATION
NITRATE REMOVAL PLANT
PURCHASE WATER FROM LOCAL PROVIDER
WASTEWATER REUSE
WICHITA BASIN CHLORIDE CONTROL PROJECT
WICHITA RIVER DIVERSION

SUMMARY OF RECOMMENDED STRATEGIES

Entity	County Used	Basin Used	Strategy	Total Capital Cost	1st Decade Unit Cost ($/AF)	2010 (AF/YR)	2020 (AF/YR)	2030 (AF/YR)	2040 (AF/YR)	2050 (AF/YR)	2060 (AF/YR)	2060 Unit Cost ($/AF)
Regional	Wichita	Red	Chloride Control Project	$95,450,000	$286	26,500	26,500	26,500	26,500	26,500	26,500	$47
City of Wichita Falls	Wichita	Red	Construction of Lake Ringgold	$382,900,000	$386	0	0	0	0	27,000	27,000	$386
County - Other	Montague	Red and Trinity	Develop Additional Groundwater Supplies	$2,283,500	$615	584	584	584	584	584	584	$274
Irrigation	Wichita	Red	Wichita RiverDiversion	$5,380,000	$73	0	0	0	0	8,850	8,850	$73
Irrigation	Wichita	Red	Enclose Canal Laterals in Pipe	$7,658,469	$52	13,034	13,034	13,034	13,034	13,034	13,034	$1
Irrigation	Archer	Red	Increase water conservation elevation	$26,000	$0.50	0	1,344	1,386	1,426	1,465	1,584	$0
Irrigation	Clay	Red	Increase water conservation elevation	$26,000	$0.50	0	331	309	284	253	274	$0
City of Wichita Falls	Wichita	Red	Increase water conservation elevation	$26,000	$0.50	0	3,364	3,366	3,358	3,350	3,340	$0
Irrigation	Wichita	Red	Increase water conservation elevation	$26,000	$0.50	0	15,995	11,186	10,392	9,605	8,687	$0
Steam Electric Power	Wilbarger	Red	Increase water conservation elevation	$26,000	$0.50	0	3,800	8,529	9,258	9,987	10,715	$0
Baylor WSC	Baylor	Brazos	Interconnect with Resevoir	$714,000	$1,252	250	250	250	250	250	250	$1,000
County - Other	Archer	Brazos, Red and Trinity	Municipal Conservation	$0	$1,429	7	11	14	16	17	18	$556
Lakeside City	Archer	Red	Municipal Conservation	$0	$1,667	3	9	10	11	11	11	$455
County - Other	Clay	Red and Trinity	Municipal Conservation	$0	$625	16	42	45	45	41	39	$256
City of Bowie	Montague	Trinity	Municipal Conservation	$0	$55	8	34	34	61	69	72	$230
City of Iowa Park	Wichita	Red	Municipal Conservation	$0	$735	21	57	68	72	76	80	$269
City of Wichita Falls	Wichita	Red	Municipal Conservation	$0	$10	124	533	548	556	562	1,367	$80
County - Other	Archer	Brazos, Red and Trinity	Purchase Water	$364,000	$1,750	296	296	296	296	296	296	$1,642
Lakeside City	Archer	Red	Purchase Water	$0	$1,059	12	12	12	12	12	12	$1,059
County - Other	Clay	Red and Trinity	Purchase Water	$364,000	$1,462	223	223	223	223	223	223	$1,319
Mining	Montague	Red and Trinity	Purchase Water	$412,000	$1,362	177	177	177	177	177	177	$1,159
City of Iowa Park	Wichita	Red	Purchase Water	$0	$1,059	229	229	229	229	229	229	$1,059
Manufacturing	Wichita	Red	Purchase Water	$0	$1,059	462	462	462	462	462	462	$1,059
Lockett Water System	Wilbarger	Red	Purchase Water	$1,658,700	$2,266	109	109	109	109	109	109	$936
Charlie WSC	Clay	Red	Nitrate Removal plant	$200,500	$2,550	10	10	10	10	10	10	$800
Hinds-Wildcat System	Wilbarger	Red	Nitrate Removal plant	$446,500	$1,363	40	40	40	40	40	40	$388
City of Bowie	Montague	Trinity	Wastewater Reuse	$1,206,500	$950	0	0	0	171	171	171	$950

SUMMARY OF ALTERNATE STRATEGIES

Entity	County Used	Basin Used	Strategy	Total Capital Cost	1st Decade Unit Cost ($/AF)	2010 (AF/YR)	2020 (AF/YR)	2030 (AF/YR)	2040 (AF/YR)	2050 (AF/YR)	2060 (AF/YR)	2060 Unit Cost ($/AF)
City of Bowie	Montague	Trinity	Develop Additional Groundwater Supply	$1,650,000	$1,200	171	171	171	171	171	171	$357
Mining	Montague	Red	Develop Additional Groundwater Supply	$654,000	$447	177	177	177	177	177	177	$125
County - Other	Montague		Purchase Water	$364,500	$1,200	584	584	584	584	584	584	$1,145
Hinds-Wildcat System	Wilbarger	Red	Purchase Water	$848,000	$3,050	40	40	40	40	40	40	$1,200
City of Wichita Falls	Wichita	Red	Wastewater Reuse	$57,100,000	$770	11,000	11,000	11,000	11,000	11,000	11,000	$317

CHAPTER 5

IMPACTS OF SELECTED WATER MANAGEMENT STRATEGIES ON KEY PARAMETERS OF WATER QUALITY AND IMPACTS OF MOVING WATER FROM RURAL AND AGRICULTURAL AREAS

TEXAS STATE WATER PLAN

REGION B

SEPTEMBER 2010

IMPACTS OF SELECTED WATER MANAGEMENT STRATEGIES ON KEY PARAMETERS OF WATER QUALITY AND IMPACTS OF MOVING WATER FROM RURAL AND AGRICULTURAL AREAS TEXAS STATE WATER PLAN REGION B

5.1 Introduction

The regulations that describe the content and process for the development of regional water plans direct that the plan include "a description of the major impacts of recommended water management strategies on key parameters of water quality identified by the regional water planning group . . ." and "impacts on agricultural resources." [30 TAC 357.7(a)(12) ; 30 TAC 357.7(a)(8)]. In the 2006 Region B Regional Water Plan this chapter provided information and recommendations to assist the Regional Water Planning Group B (RWPG-B) to identify the key water quality parameters that may be impacted by implementation of recommended water management strategies (WMS) that were included in the 2006 plan. This chapter presents an identification of the potential WMS for RWPG-B and an assessment of the key water quality parameters that could be affected by the implementation of each WMS. Based on this assessment, recommendations are made with respect to which parameters should be designated as key water quality parameters for each type of WMS. From this determination, the specific water management strategies selected for Region B were evaluated for potential impacts on the identified key parameters.

In addition, this chapter provides information relating to the potential impacts of moving water used for rural or agricultural purposes to urban uses.

5.2 Summary of Key Water Quality Parameters

The key water quality parameters to be evaluated are dependent on the proposed WMS. Table 1 summarizes the most pertinent water quality parameters for the types of WMS expected to be proposed in the Region B Water Plan. It is recommended that these be identified as the key water quality parameters for evaluating the Region B WMS.

The implementation of specific WMS can potentially impact both the physical and chemical characteristics of water resources in the region. Following is an assessment of the characteristics of each WMS that can affect water quality, and an identification of the specific water quality parameters that could be affected based on those characteristics.

5.2.1 Expanded Use of Surface Water Resources

This WMS includes increased use of water in streams and in existing reservoirs along with development of new reservoirs. In these cases, the primary physical impact is a decrease in the volume of water. From a water quality perspective, a decrease in volume is more likely to be significant in a stream than in a reservoir. Several conditions can develop as stream flows decrease that may impact water quality:

- The water quality parameters most likely to be affected are total dissolved solids (TDS) and nutrients. With increased use of surface water sources there is likely to be less dilution for stream inflows. If those inflows are associated with treated industrial wastewater, treated domestic wastewater, discharges of power plant cooling water blowdown, or groundwater seeps or springs with high concentrations of minerals, then the quality of the stream can be affected with increased TDS or nutrient levels. However, for permitted discharges, permit limits would be adjusted to avoid adverse impacts.
- In some cases there could be an increase in the concentration of one or more metals in the stream as a result of a decrease in the dilution of discharge flows. However, this potential is dependent on the types of discharges to the stream.
- In addition, a decrease in stream flow could decrease the stream’s ability to assimilate loadings of oxygen-demanding materials such as biochemical oxygen demand (BOD) and ammonia associated with permitted discharges or non-point sources. The water quality parameter affected would be dissolved oxygen (DO). However, as discussed above, for permitted discharges, it is expected that permit limits for BOD and ammonia

Table 1 Region B 20110 Water Plan, Evaluation of Water Management Strategy Impacts on Key Water Quality Parameters

Water Quality Parameter	Water Management Strategy							
	Expanded Use of Surface Water		New Reservoirs	Interbasin Transfers	Expanded Use of Reclaimed Water	Expanded Use of Groundwater	Water Conservation	Special Water Management Strategy
	Streams	Lakes						
TDS	X	X	X	X	X	X		X
Alkalinity				X		X		
Hardness				X		X		
Dissolved Oxygen	X	X	X	X	X			
Nitrogen	X	X	X	X	X			
Phosphorus	X	X	X	X	X			
Metals[1]	X	X	X	X	X	X		
Sediment Quality			X					X
Turbidity				X				

[1] Only for specific metals where there are significant discharges of the metal.

would be appropriately adjusted to avoid adverse impacts and to maintain compliance with the DO criteria in the Texas Surface Water Quality Standards. However, the amount of water in the stream could be reduced to the point that DO would be significantly impacted, and water quality standards would not be met even with stringent permit limits. In some cases, the DO standard may not be maintained even when there are no permitted discharges. If the DO standard is not maintained, the affected stream could be included on the List of Impaired Waters prepared by the Texas Commission on Environmental Quality (TCEQ) pursuant to Section 303(d) of the Clean Water Act. Inclusion on that list could have significant implications for point and non-point sources in the watershed.

The potential for significant water quality impacts as a result of increased use of waters from a reservoir is much lower than that associated with increased use of a stream. Even if increased use of the reservoir requires significant construction of pipelines or an intake structure, the potential for impact is low. Existing requirements for stormwater permits for construction activity and 404 permits for construction in waterbodies minimize the potential for water quality impacts.

In most cases, there is very little possibility of significant impacts on water quality in a reservoir as a result of increased use. If impacts occur, they are most likely to occur in the stream below the reservoir. Increased usage of a reservoir can result in decreased releases from the reservoir and, thus, a decrease in downstream flow. This decrease in downstream flow below a reservoir could have the same impacts as discussed immediately above. However, during drought of record conditions there should be little to no change in to reservoir releases.

5.2.2 New Reservoirs

The most potentially significant impact of new reservoir construction is the inundation of bottomlands and a decrease in instream flows below the reservoir. If this occurs, the potential impacts include those described in the previous section when instream flow is reduced due to increased stream usage, i.e., potential impacts on TDS, nutrients, DO, and, in some cases, metals.

Another factor to consider with respect to new reservoirs may be the potential for effects due to increased sedimentation downstream of the reservoir when the median flow is reduced. If the soils in the watershed that drains to the stream below the reservoir are highly erodible, and flow velocities in the stream are reduced, then the rate of accumulation of sediments in the stream may increase. This condition may be further exacerbated by the fact that, if there were no reservoir, relatively small flood events (which occur more frequently than floods sufficient in size to produce major releases from a reservoir) would more frequently scour out these sediment deposits. Without these scouring events, the sediments will continue to accumulate. Depending on the nature of land uses in the watershed, these sediments could create a nutrient-rich or highly organic layer in the streambed. The combination of shallower flow depths and higher concentrations of nutrients could produce significant growths of algae and/or aquatic vegetation in the stream. Either the algal growth or the organic matter in the sediments could also affect the DO concentration in the stream.

However, studies have shown that reservoirs do not always reduce median downstream flows. Because they capture store flood flows, the routine release rates are often greater than the median downstream flow that occurred prior to the reservoir. An increase in downstream flow is not expected to have adverse water quality impacts, but may create stream stability issues. The higher median flow may consist of low turbidity water due to the reservoir detention time. Low turbidity water is often characterized as “hungry” water meaning that it has the capability to pick up and transport sediment from the streambed, promoting stream erosion and channel degradation.

These downstream flow issues and others are assessed in the environmental permitting process for a new reservoir. The water supply releases will be evaluated along with instream flow requirements so that water quality and environmental impacts are minimized.

Significant water quality impacts have resulted from reservoir construction when the dam release structures are designed to release water from the hypolimnion or the bottom of the reservoir. During the summer season, water quality concerns with respect to waters in the hypolimnion include decreased oxygen levels, low temperature, and high nutrient concentrations. However, there is currently an awareness of this problem, and it is not anticipated that a new dam would be constructed that would only release water from the hypolimnion.

5.2.3 Interbasin Water Transfers

If waters are transferred from one basin to another, there can be a decrease in instream flows downstream of the diversion point. The water quality parameters potentially impacted by that action are as previously discussed: TDS, nutrients, DO, and, in some cases, metals and turbidity. Additionally, changes in TDS, alkalinity, hardness, or turbidity can impact water users, particularly industrial users that have treatment processes to produce high quality waters (for boiler feed, for example) and water treatment plants. Water treatment processes are tailored to the quality of the water being treated. If the quality of the feed water changes, the treatment process may have to be changed, also.

Changes in nutrient concentrations or water clarity can affect the extent of growth of algae or aquatic vegetation in a stream. The same concentration of nutrients can produce different levels of algal growth in different waterbodies depending on factors such as water clarity, shading, stream configuration, or other chemical constituents in the waters.

With respect to water clarity, there are also aesthetic considerations. It is generally not desirable to introduce waters with higher turbidity, or color, into high clarity waters.

5.2.4 Expanded Use of Reclaimed Waters

In general, there are three possible water quality effects associated with an increased use of reclaimed water:

- There can be a reduction in instream flow if treated wastewaters are not returned to the water supply stream. This could affect TDS, nutrients, DO, and metals concentrations.
- Conversely, in some cases, reducing the volume of treated wastewater discharged to a stream could have a positive effect, reducing concentrations of TDS, nutrients, and metals, and increasing DO concentrations.

- Reusing water multiple times and then discharging it can significantly increase the TDS concentration in the effluent and, thus, in the receiving stream.

5.2.5 Expanded Use of Groundwater Resources

Increased use of groundwater can decrease instream flows, if the base flow is supported by spring flow. This is not known to be a significant factor for streams in Region B.

There is a potential that increased use of groundwater will increase TDS concentrations in area streams. Groundwaters often contain higher concentrations of TDS and hardness than are considered desirable for domestic uses. Homeowners may install treatment systems to reduce TDS or hardness, which may introduce small volumes of high TDS water to municipal wastewater systems or area streams. Because these discharges are expected to be small, the overall impacts should be negligible.

There could also be WMS proposed to treat brackish or high nitrate groundwater with a membrane or ion exchange system in order to increase the suitability of those waters for domestic use. These treatment systems create a waste stream that is high in TDS. Disposal of this waste stream could adversely affect TDS concentrations and sediment quality in area waters. However, in Region B many streams have naturally occurring salts and high TDS levels, so that the impact from these systems could be minimal. In some cases, concentrations of TDS in wastewater discharges containing waste streams from these treatment systems are not significantly different from the stream standards.

5.2.6 Water Conservation

The water conservation measures most likely to be recommended in Region B are not expected to affect water quality adversely. Some factors may increase TDS concentrations while other factors could decrease TDS concentrations. The overall results should be beneficial because the demand on surface and groundwater resources will be decreased. Assessing and quantifying both positive and negative impacts would be highly complex and is beyond the scope of this planning effort.

5.3 Impacts of Region B Water Management Strategies on Key Water Quality Parameters

The Region B Water Planning Group is proposing eight preferred water management strategies. These strategies are as follows:

- Increase water conservation pool elevation of Lake Kemp
- Purchase water from local providers
- Wastewater reuse
- Expanded use of groundwater
- Nitrate removal
- Water Conservation (municipal and irrigation)
- Construct Lake Ringgold
- Wichita River diversion

The description of each of these WMS follows.

5.3.1 Increase Lake Kemp Conservation Pool

One of the Region B strategies is to increase the conservation pool level in Lake Kemp. Implementation of this strategy will compensate for the decreases in the total storage capacity of Lake Kemp due to sediment accumulation. It is anticipated that the total storage in the lake will not increase above the current permitted volume; however, this will be determined during the detailed studies to support the increase in conservation pool. Entities that will benefit from this strategy are as follows:

- Archer County – Irrigation
- Clay County – Irrigation
- Wichita County – Irrigation
- City of Wichita Falls – Municipal
- Wilbarger County – Steam-Electric Power Generation

Implementation of this strategy will provide additional water supplies with no significant negative impact on water quality. A positive impact on water quality may result from greater capture and storage of high flow events when TDS levels are typically lower.

5.3.2 Purchase Water from Local Provider

It is proposed that the following entities purchase additional water from local providers. These entities are as follows:

- Archer County – Other
- Lakeside City
- Clay County – Other
- Montague County – Mining
- Iowa Park
- Wichita County – Manufacturing
- Wilbarger County – Manufacturing
- Lockett Water System

Additional water use from existing surface and groundwater supplies can decrease the quantity of available water in reservoirs and streams. However, the amount of additional water use by these entities is not expected to significantly increase current water use from area water sources, and will not likely impact water quality.

5.3.3 Wastewater Reuse

Wastewater reuse is a potential alternate strategy for the City of Wichita Falls and a selected WMS for Bowie. Treated wastewater effluent will be used for irrigation on non-agricultural, municipal properties. The proposed project for Wichita Falls includes the reuse of 11,000 acre-feet per year of treated effluent. This project could have positive impacts on key water quality parameters downstream of the current discharge. The project would result in a decrease in the volume of water discharged via the City of Wichita Falls' wastewater treatment system to the Wichita River. The reduction in discharge could reduce the TDS loading into the Wichita River, and increase DO levels immediately downstream of the discharge by the reduction in BOD loading. Any metals that may be present in the treated effluent would likewise be reduced in the receiving stream.

The WMS for the City of Bowie includes the development of 171 acre-feet per year of wastewater reuse for the irrigation of recreational areas within the city, eliminating this demand from the potable water system.

5.3.4 Expanded Use of Groundwater

The preferred management strategies for Region B include the expanded use of groundwater. As currently proposed, Montague County (Other) and Montague County (Mining) will benefit from additional groundwater. At the proposed pumping rates these strategies will not have a significant impact on water quality in the aquifer.

5.3.5 Nitrate Removal

Several of the groundwater sources in Region B exhibit nitrate levels that exceed the EPA primary drinking water standard. These waters have to be treated by advanced technology (e.g., reverse osmosis) in order to reduce drinking water nitrate levels to an acceptable level. The cities of Burkburnett, Seymour, and Vernon have installed this treatment technology at their water treatment plants. Additional water supply systems which have experienced nitrate problems include Charlie Water Supply Corporation and Hinds – Wildcat. Current technologies are available for nitrate removal; however, disposal of filter backwash and residuals remains a concern with respect to water quality. Potential impacts and appropriate mitigation, if needed, will be addressed during the permitting process.

5.3.6 Water Conservation

As required by Senate Bill 2, water conservation was considered when developing water management strategies for water user groups with needs. Conservation strategies appropriate for Region B were evaluated based on the best management practices identified through the State Water Conservation Implementation Task Force and development of the Wichita County Water Improvement District No. 2, Water Conservation Implementation Plan (April, 2009) under special study funding approved by the TWDB in 2007.

After review and consideration of these strategies, the recommended conservation package for Region B included the following five management practices:

- Public and School Education
- Reduction of Unaccounted for Water through Water Audits
- Water Conservation Pricing
- Federal Clothes Washer Rules
- Conversion of irrigation laterals to pipelines

Implementation of water conservation practices will help address regional water needs with no significant impact to water quality.

5.3.7 Construct Lake Ringgold

Lake Ringgold is recommended as a WMS to address City of Wichita Falls water needs in 2050 and beyond. This reservoir, located on the Little Wichita River in Clay County east of Henrietta, will inundate about 15,000 aces at conservation capacity. The Reservoir Site Protection Study (TWDB, Report 370, Reservoir Site Protection Study, July 2008) did not identify significant environmental or water quality concerns for the site. The analysis for this project assumed instream flow releases in accordance with the Consensus Criteria for Environmental Flow Needs. Flow releases from storage will reduce downstream impacts. Detailed environmental studies will be required during the permitting and design of this reservoir. Potential impacts and appropriate mitigation, if needed, will be addressed during the permitting process.

5.3.8 Wichita River Diversion

Diversion of additional surface water from the Wichita River by the Wichita County Water Improvement District No. 2 under an existing water right (Certificate of Adjudication 02-5123) for irrigation use is a recommended WMS for the region with implementation in the 2040 decade. This project would be implemented by constructing a pump station and intake on the Wichita River near one of the existing irrigation laterals and supplementing flow in the system. This diversion from the river is not expected to significantly impact downstream flow or water quality as a significant volume of water is already returned to the river through end-of-lateral spills from the irrigation system. A portion of the flow diverted under this WMS is similarly expected to return to the river.

Water quality impacts from implementing this strategy are expected to be minimal even though downstream flows may be reduced during diversion periods. Diversions will be limited to periods when there is sufficient flow in the river to accommodate pumping. As such, diversion will be limited to periods when streamflow is greater and water quality conditions, reflected by lower TDS levels, are improved.

5.4 Impacts of Moving Rural Water to Municipal Uses

The recommended strategy for Montague County (other) is to develop additional groundwater from the Trinity aquifer. Since these needs are not located within an urban area there is not a transfer of rural water to municipal use.

CHAPTER 6

WATER CONSERVATION AND DROUGHT MANAGEMENT RECOMMENDATIONS

TEXAS STATE WATER PLAN

REGION B

SEPTEMBER 2010

WATER CONSERVATION AND DROUGHT MANAGEMENT RECOMMENDATIONS

TEXAS STATE WATER PLAN

REGION B

6.1 Introduction

Water conservation is a potentially feasible water savings strategy that can be used to preserve the supplies of existing water resources. Some of the demand projections developed for regional water planning incorporate an expected level of conservation to be implemented over the planning period. For municipal use, the assumed reductions in per capita water use are the result of the implementation of the State Water-Efficiency Plumbing Act. On a regional basis, this is about a 5.4 percent reduction in municipal water use by year 2060 (from a regional per capita use of 165 gallons per person per day to 156 gallons per person per day). Additional municipal water savings may be expected as the federal mandate for water-efficient clothes washing machines took effect in 2007.

Advanced drought planning and conservation can also be used to protect water supplies, as well as increase reliability during drought conditions. Drought contingency plans are required of all public water suppliers and irrigation districts, and they serve as a temporary strategy to limit water use during drought conditions. Conservation and drought contingency are related strategies, and adherence to the former can ease the burden of the latter. Nevertheless, all water suppliers must be prepared to address water shortages in the event of a severe drought situation.

Senate Bill 1 requires each region's water plan to address conservation and drought management for each supply source within the region. This includes both groundwater and surface water. In fulfillment of this requirement, the remainder of this chapter will serve to identify users and suppliers required to submit water conservation plans and drought contingency plans, respectively, as well as to identify appropriate conservation measures for different types of users. Model water conservation and drought contingency plans for the various types of entities are provided as Attachments 6-1 and 6-2, respectively.

6.2 Water Conservation Plans

The TCEQ defines water conservation as “a strategy or combination of strategies for reducing the volume of water withdrawn from a water supply source, for reducing the loss or waste of water, for maintaining or improving the efficiency in the use of water, for increasing the recycling and reuse of water, and for preventing the pollution of water.”

Since 1997, the TCEQ has required water conservation plans for all municipal and industrial water users with surface water right of 1,000 acre-feet per year or more and irrigation water users with surface water right of 10,000 acre-feet per year or more (Texas Water Code, Section 11.1271). Water conservation plans are also required for all water users applying for a State water right, and may also be required for entities seeking State funding for water supply projects. Legislation passed in 2003 adds a requirement that all conservation plans specify quantifiable 5-year and 10-year conservation goals and targets. While these goals are not enforceable, they must be identified. All updated water conservation plans, reflecting these new goals, must be submitted to the Executive Director of the TCEQ and to the Regional Water Planning Group by May 1, 2009.

Senate Bill (SB) 3 of the 80th Texas Legislature also added the requirement that all existing and new water providers with 3,300 or more connections must develop water conservation plans in addition to those previously required to develop plans. This bill also required that all water conservation plans be submitted to the Texas Water Development Board (TWDB) in addition to the TCEQ and that entities report annually on progress in implementing the plan with the first report due by May 1, 2010. The annual reports are required to include the following:

- The list of dates and descriptions of the conservation measures implemented.
- Data about whether or not targets in the plans are being met.

- The actual amount of water conserved.
- If the targets are not being met, an explanation as to why the targets are not being met, including any progress on that particular target.

In Region B, the TCEQ records show that seven entities hold municipal or industrial rights in excess of 1,000 acre-feet per year or have 3,300 or more connections, and one entity holds irrigation water rights greater than 10,000 acre-feet per year. Of the seven entities holding water rights in excess of 1,000 acre-feet per year, American Electric Power (AEP) is recorded as holding the water rights for Lake Pauline. However, AEP has sold Lake Pauline and the associated rights to another party.

A list of the users in Region B required to submit water conservation plans is shown in Table 6.1. Each of these entities is required to develop and submit to the TCEQ, TWDB, and the Regional Water Planning Group a water conservation plan. Several other water users have contracts with regional water providers for water of 1,000 acre-feet per year or more. Presently, these water users are not required to develop water conservation plans unless the user is seeking State funding; however, a wholesale water provider may require that its customers prepare a conservation plan to assist in meeting the goals and targets of the wholesale water provider's plan.

Table 6-1:
Region B Water Users Required to Prepare Water Conservation Plans[1]

WUG	Type of Use
City of Bowie	Municipal
City of Henrietta	Municipal
City of Olney	Municipal
City of Wichita Falls	Municipal
North Montague County	Municipal
Red River Authority	Municipal[2]
Wichita County WID No. 2	Irrigation

1. AEP is not included in this list because they no longer own Lake Pauline.
2. The Red River Authority holds surface water rights in Lake Texoma, which is located in Region C

In addition to water users listed in Table 6-1, North Central Texas MWA owns and operates Millers Creek Lake, which is located in both Regions B and G. Currently North Central Texas MWA serves customers only in Region G and planning for this entity is included in the Brazos G water plan.

To assist entities in the Region B area with developing water conservation plans, model plans for municipal water users, wholesale or retail public water suppliers, industrial users, and irrigation districts are included in Attachment 6-1. These models have been modified since the 2006 Region B Plan. Each model plan addresses the latest TCEQ requirements and is intended to be modified by a user to best reflect the activities appropriate to the entity.

Some of the conservation activities for municipal water users in Region B include:

- Education and public awareness programs.
- Reduction of unaccounted for water through water audits and maintenance of water systems.
- Water rate structures that discourage water waste.

Industrial water users in Region B include several power plants as well as local manufacturers. Conservation activities associated with industries are very site and industry-specific. Some industries can utilize brackish water supplies or wastewater effluent while others require only potable water. It is important in evaluating conservation strategies for industries to balance the water savings from conservation to economic benefits to the industry and the region. Requiring costly changes to processes and equipment may not be practical and beneficial to the region at this point in time.

In light of these considerations, the focus of conservation activities for industrial users should be:

- Evaluation of water saving equipment and processes.

- Water rate structures that discourage water waste.

The only large irrigation district in Region B is the Wichita County Water Improvement District No. 2, which holds an irrigation water right of 120,000 acre-feet per year. Appropriate conservation activities for large irrigators in the Region B area include:

- Reduction in operational losses and seepage losses associated with unlined laterals in the conveyance system by conversion to pipelines.
- Coordination of irrigation deliveries to maximize efficiencies.
- Encourage irrigation customers to use of water saving irrigation equipment and water conserving irrigation and land management practices.

A conveyance system study of the Wichita County Water Improvement District No. 2 was conducted in 2009 to assess water conservation that could be achieved by enclosing laterals in pipe. Water used for irrigation is currently conveyed through laterals, which incur significant operational and seepage losses. The study identified and evaluated candidate laterals and estimated potential water savings from conversion of 10 laterals, considered to have high losses, to pipelines. Approximately 13,034 acre-feet per year of water may be conserved if all evaluated laterals are converted, which could satisfy a portion of the 2010 water shortage of 22,946 acre-feet per year for irrigation uses. This amount is almost half of the projected 2060 irrigation water shortage of 27,201 acre-feet per year, indicating that either additional laterals would need to be evaluated for conversion to pipelines or other strategies will be needed to satisfy the irrigation water needs of the region. Cost estimates and potential funding sources were also evaluated in the study. The Executive Summary of the “Final Report of the Wichita County Water Improvement District No. 2 Water Conservation Implementation Plan” is included in Attachment 4-4.

6.3 Drought Contingency Plans

Drought management is a temporary strategy to conserve available water supplies during times of drought or emergencies. This strategy is not recommended to meet long-term growth in demands, but rather acts as a means to minimize the adverse impacts of water supply shortages during drought. Drought contingency plans are required of all wholesale and retail public water suppliers and irrigation districts by the Texas Water Code (Section 11.1272) and by TCEQ Rules (30 TAC Chapter 288). A drought contingency plan may also be required for entities seeking State funding for water projects. In general, drought contingency plans must include, at minimum, the following elements:

- Provisions for public input.
- Provisions for public education.
- Coordination with the Regional Water Planning Group.
- Criteria for initiation and termination of drought response stages.
- Identification of drought response stages.
- Assessment of water management strategies for specific drought conditions.
- Procedures for notification of the public.
- Methods for determining the allocation of supplies to individual users (irrigation plans).
- Monitoring procedures to initiate or terminate a drought response stage.
- Procedures for accounting for use during implementation of water allocation (irrigation plans) .
- Supply or demand measures to be implemented during the stages of the plan.
- Procedures for granting variances.
- Procedures for enforcement of water use restrictions.

Drought contingency plans typically identify different stages of drought and specific triggers and response for each stage. In addition, the plan must specify quantifiable targets for water use reductions for each stage, and a means and method for enforcement.

As with the water conservation plans, drought contingency plans are to be updated and submitted to the TCEQ and the RWPG by May 1, 2009.

Drought contingency plans were developed for entities in Region B during the initial regional water planning effort in 2001 with forty six total plans prepared. Each plan identifies at least four drought stages: mild, moderate, severe, and emergency. The responses range from notification of drought conditions and voluntary reductions in the "mild" stage to mandatory restrictions during an "emergency" stage. Each entity selected trigger conditions for the different stages and an appropriate response. The majority of the plans use trigger conditions based on the demands placed on the water distribution system, but can also trigger drought stages based on a supplier's request to reduce demand. Of the plans reviewed, eleven users based drought triggers on well levels, eight based triggers on reservoir levels, and two based triggers on climate or weather conditions.

Updated model drought contingency plans for irrigation uses and public water supply entities are included in Attachment 6-2.

Drought trigger conditions for surface water supply are customarily related to reservoir levels. The Region B Regional Water Planning Group will be working with the regional operators of reservoirs to establish the trigger conditions. Trigger conditions which have been ascertained for the region's reservoirs follow:

Lake Kickapoo and Lake Arrowhead

The City of Wichita Falls operates Lake Kickapoo and Lake Arrowhead. The following describes the existing drought stages triggers in these lakes under the City's DCP:

- Stage 1 – "Drought Watch" combined storage falls below 60% of conservation storage.
- Stage 2 – "Drought Warning" combined storage level falls below 50% of conservation storage

- Stage 3 – Drought Emergency” combined storage level falls below 40% of conservation storage
- Stage 4 – “Drought Disaster” combined storage level falls below 30% of conservation storage

Lake Kemp

The Wichita County Water Improvement District operates Lake Kemp. The following describes the existing drought stages triggers for this lake under the District’s DCP:

- Stage 1 – Lake elevation drops below 1,133 ft msl
- Stage 2 – Lake elevation drops below 1,130 ft msl
- Stage 3 – Lake elevation drops below 1,123 ft msl
- Stage 4 – Lake elevation drops below 1,114 ft msl

Petrolia City Lake

The City of Petrolia operates Petrolia City Lake. The following describes the existing drought stages triggers for this lake under the City’s DCP:

- Stage 1 – Lake storage drops below 60% capacity
- Stage 2 – Lake storage drops below 50% capacity
- Stage 3 – Lake storage drops below 35% capacity

Lakes Olney and Cooper

The City of Olney operates Lakes Olney and Cooper. The following describes the existing drought stages triggers for this lake under the City’s DCP:

- Stage 1 – Lake elevation drops below 1,135 ft msl
- Stage 2 – Lake elevation drops below 1,133 ft msl

- Stage 3 – Lake elevation drops below 1,130 ft msl
- Stage 4 – Lake elevation drops below 1,127 ft msl

Megargel City Lake

The City of Megargel operates City Lake. The following describes the existing drought stages triggers for this lake under the City's DCP:

- Stage 1 – Lake elevation drops 7 feet below normal pool
- Stage 2 – Lake elevation drops 9 feet below normal pool
- Stage 3 – Lake elevation drops 11 feet below normal pool

North Fork Buffalo Creek Lake

The City of Iowa Park operates North Fork Buffalo Creek. The following describes the existing drought stages triggers for this lake under the City's DCP:

- Stage 1 – June 1
- Stage 2 – Lake elevation drops below 1,040 ft msl
- Stage 3 – Lake elevation drops below 1,038 ft msl
- Stage 4 – Lake elevation drops below 1,032 ft msl
- Stage 5 – Lake elevation drops below 1,030 ft msl or emergency

The City of Iowa Park also includes the Wichita Falls drought triggers in its DCP.

Lake Electra

The City of Electra operates Lake Electra. The following describes the existing drought stages triggers for this lake under the City's DCP:

- Stage 1 – Lake storage drops below 1,700 acre-ft
- Stage 2 – Lake storage drops below 1,500 acre-ft

- Stage 3 **–** Lake storage drops below 1,300 acre-ft
- Stage 4 **–** Lake storage drops below 1,000 acre-ft

Lake Amon G. Carter

The City of Bowie operates Lake Amon G. Carter. The following describes the existing drought stages triggers in these lakes under the City's DCP:

- Stage 1 **–** Lake elevation drops below 916 feet msl
- Stage 2 **–** Lake elevation drops below 912 feet msl
- Stage 3 **–** Lake elevation drops below 908 feet msl

6.3 Water Loss and Water Audit

The 78th Texas Legislature passed legislation in 2005 requiring retail public utilities that provide potable water to perform a water audit, computing the utility's most recent annual water loss every five years. The TWDB established new requirements for water audit reporting, which require public utilities to audit their water system once every five years and report water loss data to the TWDB. The first set of water loss data was to be submitted to the TWDB by March 31, 2006. The TWDB funded a study to evaluate water loss survey responses from all retail utilities in Texas, and published the report, *An Analysis of Water Loss as Reported by Public Water Suppliers in Texas*[33] in 2007. The Executive Summary of this report and a comparison of water loss on a regional basis is provided in Attachment 6-3.

6.4 Summary of Water Conservation and Drought Management Recommendations

Water conservation and drought management are often a way of life in Region B. With frequent periods of drought, water providers recognize the importance of active management and conservation of local water resources. The Region B Water Planning Group also recognizes that advanced water conservation measures (i.e. savings associated with active conservation measures for municipal and industrial uses) will be implemented by local governing entities or water users as conditions arise. The recommended strategies presented in this plan provide a framework which water providers can use to develop plans and/or strategies to meet their needs. Region B Planning Group supports the use and consideration of any water conservation strategy deemed appropriate by a water user.

Acknowledging the importance of water conservation to meet future water needs in Region B, this water plan recommends several water conservation strategies for users with identified needs:

- Municipal conservation
- Municipal reuse
- Irrigation conveyance loss reduction through conversion of laterals to pipelines

The amount of conservation from each of these strategies relative to the other new supply strategies is shown in Table 6-2. In the short-term conservation is 96 percent of the total supply, but by 2060, as new supplies are developed, conservation represents about 20 percent of the new supplies.

Table 6-2:
Conservation Relative to Total New Supplies
(acre-feet per year)

	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Conservation Strategies						
Additional Municipal Conservation	197	764	799	841	857	1,668
Bowie Reuse				171	171	171
Lake Kemp Canal Project	13,034	13,034	13,034	13,034	13,034	13,034
Total Conservation	**13,231**	**13,798**	**13,833**	**14,046**	**14,062**	**14,873**
Other New Supplies						
Increase Conservation Elev. of Lake Kemp	0	24,834	24,776	24,718	24,660	24,600
Wichita River Diversion	0	0	0	8,850	8,850	8,850
Groundwater Development Montague County-Other	485	554	572	584	567	572

Construct Lake Ringgold	0	0	0	0	27,000	27,000
Total – New Supplies[1]	**13,716**	**39,204**	**39,181**	**48,198**	**75,139**	**75,895**
% Conservation	96%	35%	35%	29%	19%	20%

[1] New supplies include conservation savings.

ATTACHMENT 6-1

REGIONAL WATER PLANNING GROUP B

MODEL WATER CONSERVATION PLANS

Texas Commission on Environmental Quality

UTILITY PROFILE & WATER CONSERVATION PLAN REQUIREMENTS FOR MUNICIPAL WATER USE BY PUBLIC WATER SUPPLIERS

This form is provided to assist entities in water conservation plan development for municipal water use by a retail public water supplier. Information from this form should be included within a water conservation plan for municipal use. If you need assistance in completing this form or in developing your plan, please contact the conservation staff of the Resource Protection Team in the Water Supply Division at (512) 239-4691.

Name of Entity: ____

Address & Zip: ____

Telephone Number: ________________________ **Fax:** ________________

Form Completed By:____

Title: ____

Signature: ________________________ **Date:** ________________

Name and Phone Number of Person/Department responsible for implementing a water conservation program: ____

UTILITY PROFILE

I. POPULATION AND CUSTOMER DATA

A. Population and Service Area Data

1. Attach a copy of your service-area map and, if applicable, a copy of your Certificate of Convenience and Necessity (CCN).

2. Service area size (square miles): ________________________

3. Current population of service area: ________________________________

4. Current population served:

a. water ______________________
b. wastewater ______________________

5. Population served by water utility for the previous five years:

Year	Population
________	_________
________	_________
________	_________
________	_________
________	_________

6. Projected population for service area in the following decades:

Year	Population
2010	_________
2020	_________
2030	_________
2040	_________
2050	_________

7. List source/method for the calculation of current and projected population:

____
____
____
____

B. Active Connections

1. Current number of active connections. Check whether multi-family service is counted as Residential _____ or Commercial _____

Treated water users:	Metered	Not-metered	Total
Residential	________	__________	______
Commercial	________	__________	______
Industrial	________	__________	______
Other	________	__________	______

2. List the net number of new connections per year for most recent three years:

Year	________	________	________
Residential	________	________	________
Commercial	________	________	________
Industrial	________	________	________
Other	________	________	________

C. High Volume Customers

List annual water use for the five highest volume customers
(indicate if treated or raw water delivery)

	Customer	Use (1,000gal./yr.)	Treated/Raw Water
(1)	____________	____________	____________
(2)	____________	____________	____________
(3)	____________	____________	____________
(4)	____________	____________	____________
(5)	____________	____________	____________

II. WATER USE DATA FOR SERVICE AREA

A. Water Accounting Data

1. Amount of water use for previous five years (in 1,000 gal.):
Please indicate : Diverted Water ________________
Treated Water ________________

Year	________	________	________	________	________
January	________	________	________	________	________
February	________	________	________	________	________
March	________	________	________	________	________

April	______	______	______	______	______
May	______	______	______	______	______
June	______	______	______	______	______
July	______	______	______	______	______
August	______	______	______	______	______
September	______	______	______	______	______
October	______	______	______	______	______
November	______	______	______	______	______
December	______	______	______	______	______
Total	______	______	______	______	______

Indicate how the above figures were determined (e.g., from a master meter located at the point of a diversion from the source or located at a point where raw water enters the treatment plant, or from water sales).

____

____

____

2. Amount of water (in 1,000 gallons) delivered (sold) as recorded by the following account types for the past five years.

Year	Residential	Commercial	Industrial	Wholesale	Other	Total Sold
____	______	______	______	______	____	______
____	______	______	______	______	____	______
____	______	______	______	______	____	______
____	______	______	______	______	____	______
____	______	______	______	______	____	______

3. List previous five years records for water loss (the difference between water diverted (or treated) and water delivered (or sold))

Year	Amount (gal.)	%
____	__________	____
____	__________	____
____	__________	____
____	__________	____
____	__________	____

4. Municipal water use for previous five years:

Year	Population	Total Water Diverted or Pumped for Treatment (1,000 gal.)
________________		___________________
________________		___________________
________________		___________________
________________		___________________
________________		___________________

B. Projected Water Demands

If applicable, attach projected water supply demands for the next ten years using information such as population trends, historical water use, and economic growth in the service area over the next ten years and any additional water supply requirement from such growth.

III. WATER SUPPLY SYSTEM DATA

A. Water Supply Sources

List all current water supply sources and the amounts authorized with each:

	Source	Amount Authorized
Surface Water:	___________________________________	______________ acre-feet
Groundwater:	___________________________________	______________ acre-feet
Contracts:	___________________________________	______________ acre-feet
Other:	___________________________________	______________ acre-feet

B. Treatment and Distribution System

1. Design daily capacity of system: ________________ MGD

2. Storage Capacity: Elevated _________ MGD, Ground ________ MGD

3. If surface water, do you recycle filter backwash to the head of the plant? Yes _______ No _______. If yes, approximately _________ MGD.

4. Please attach a description of the water system. Include the number of

treatment plants, wells, and storage tanks. If possible, include a sketch of the system layout.

IV. WASTEWATER SYSTEM DATA

A. Wastewater System Data

1. Design capacity of wastewater treatment plant(s): ___________ MGD

2. Is treated effluent used for irrigation on-site _____, off-site _____, plant washdown _____, or chlorination/dechlorination ______?
   If yes, approximately ________ gallons per month.

3. Briefly describe the wastewater system(s) of the area serviced by the water utility. Describe how treated wastewater is disposed of. Where applicable, identify treatment plant(s) with the TCEQ name and number, the operator, owner, and, if wastewater is discharged, the receiving stream. If possible, attach a sketch or map which locates the plant(s) and discharge points or disposal sites.

B. Wastewater Data for Service Area

1. Percent of water service area served by wastewater system: ______%

2. Monthly volume treated for previous three years (in 1,000 gallons):

Year	________	________	________
January	________	________	________
February	________	________	________
March	________	________	________
April	________	________	________
May	________	________	________
June	________	________	________
July	________	________	________
August	________	________	________
September	________	________	________
October	________	________	________
November	________	________	________
December	________	________	________
Total	________	________	________

REQUIREMENTS FOR WATER CONSERVATION PLANS FOR MUNICIPAL WATER USE BY PUBLIC WATER SUPPLIERS

In addition to the utility profile, a water conservation plan for municipal use by a public water supplier must include, at a minimum, additional information as required by Title 30, Texas Administrative Code, §288.2. Note: If the water conservation plan does not provide information for each requirement, an explanation must be included as to why the requirement is not applicable.

Specific, Quantified 5 & 10-Year Targets

The water conservation plan must include specific, quantified five-year and ten-year targets for water savings to include goals for water loss programs and goals for ***municipal use in gallons per capita per day*** (see Appendix A). Note that the goals established by a public water supplier under this subparagraph are not enforceable.

Metering Devices

The water conservation plan must include a statement about the water supplier's metering device(s), within an accuracy of plus or minus 5.0% in order to measure and account for the amount of water diverted from the source of supply.

Universal Metering

The water conservation plan must include and a program for universal metering of both customer and public uses of water, for meter testing and repair, and for periodic meter replacement.

Unaccounted-For Water Use

The water conservation plan must include measures to determine and control unaccounted-for uses of water (for example, periodic visual inspections along distribution lines; annual or monthly audit of the water system to determine illegal connections; abandoned services; etc.).

Continuing Public Education & Information

The water conservation plan must include a description of the program of continuing public education and information regarding water conservation by the water supplier.

Non-Promotional Water Rate Structure

The water supplier must have a water rate structure which is not "promotional," i.e., a rate structure which is cost-based and which does not encourage the excessive use of water. This rate structure must be listed in the water conservation plan.

Reservoir Systems Operations Plan

The water conservation plan must include a reservoir systems operations plan, if applicable, providing for the coordinated operation of reservoirs owned by the applicant within a common watershed or river basin in order to optimize available water supplies.

Enforcement Procedure & Plan Adoption

The water conservation plan must include a means of implementation and enforcement which shall be evidenced by 1) a copy of the ordinance, resolution, or tariff indicating **official adoption** of the water conservation plan by the water supplier; and 2) a description of the authority by which the water supplier will implement and enforce the conservation plan.

Coordination with the Regional Water Planning Group(s)

The water conservation plan must include documentation of coordination with the regional water planning group(s) for the service area of the public water supplier in order to ensure consistency with the appropriate approved regional water plans.

Example statement to be included within the water conservation plan:

The service area of the _____________ *(name of water supplier) is located within the* ___________ *(name of regional water planning area or areas) and* ___________ *(name of water supplier) has provided a copy of this water conservation plan to the* ____________ *(name of regional water planning group or groups).*

Additional Requirements:

required of suppliers serving population of 5,000 or more or a projected population of 5,000 or more within ten years)

1. Program for Leak Detection, Repair, and Water Loss Accounting

The plan must include a description of the program of leak detection, repair, and water loss accounting for the water transmission, delivery, and distribution system in order to control unaccounted-for uses of water.

2. Record Management System

The plan must include a record management system to record water pumped, water deliveries, water sales, and water losses which allows for the desegregation of water sales and uses into the following user classes (residential; commercial; public and institutional; and industrial.

Plan Review and Update

Beginning May 1, 2005, a public water supplier for municipal use shall review and update its water conservation plan, as appropriate, based on an assessment of previous five-year and ten-year targets and any other new or updated information. The public water supplier for municipal use shall review and update the next revision of its water conservation plan not later than May 1, 2009, and every five years after that date to coincide with the regional water planning group. The revised plan must also include an implementation report.

Best Management Practices Guide

On November 2004, the Texas Water Development Board's (TWDB) Report 362 was completed by the Water Conservation Implementation Task Force. Report 362 is the Water Conservation Best Management Practices (BMP) Guide. The BMP Guide is a voluntary list of management practices that water users may implement in addition to the required components of Title 30, Texas Administrative Code, Chapter 288. The BMP Guide is available on the TWDB's website at the link below or by calling (512) 463-7847.

http://www.twdb.state.tx.us/assistance/conservation/TaskForceDocs/WCITFBMPGuide.pdf

Appendix A

Definitions of Commonly Used Terms

Conservation – Those practices, techniques, and technologies that reduce the consumption of water, reduce the loss or waste of water, improve the efficiency in the use of water, or increase the recycling and reuse of water so that a water supply is made available for future or alternative uses.

Industrial use – The use of water in processes designed to convert materials of a lower order of value into forms having greater usability and commercial value, commercial fish production, and the development of power by means other than hydroelectric, but does not include agricultural use.

Irrigation – The agricultural use of water for the irrigation of crops, trees, and pastureland, including, but not limited to, golf courses and parks which do not receive water through a municipal distribution system.

Municipal per capita water use – The sum total of water diverted into a water supply system for residential, commercial, and public and institutional uses divided by actual population served.

Municipal use – The use of potable water within or outside a municipality and its environs whether supplied by a person, privately owned utility, political subdivision, or other entity as well as the use of sewage effluent for certain purposes, including the use of treated water for domestic purposes, fighting fires, sprinkling streets, flushing sewers and drains, watering parks and parkways, and recreational purposes, including public and private swimming pools, the use of potable water in industrial and commercial enterprises supplied by a municipal distribution system without special construction to meet its demands, and for the watering of lawns and family gardens.

Municipal use in gallons per capita per day – The total average daily amount of water diverted or pumped for treatment for potable use by a public water supply system. The calculation is made by dividing the water diverted or pumped for treatment for potable use by population served. Indirect reuse volumes shall be credited against total diversion volumes for the purpose of calculating gallons per capita per day for targets and goals.

Pollution – The alteration of the physical, thermal, chemical, or biological quality of, or the contamination of, any water in the state that renders the water harmful, detrimental, or injurious to humans, animal life, vegetation, or property, or to the public health, safety, or welfare, or impairs the usefulness or the public enjoyment of the water for any lawful or reasonable purpose.

Public water supplier – An individual or entity that supplies water to the public for human consumption.

Regional water planning group – A group established by the Texas Water Development Board to prepare a regional water plan under Texas Water Code, §16.053.

Retail public water supplier – An individual or entity that for compensation supplies water to the public for human consumption. The term does not include an individual or entity that supplies water to itself or its employees or tenants when that water is not resold to or used by others.

Reuse – The authorized use for one or more beneficial purposes of use of water that remains unconsumed after the water is used for the original purpose of use and before that water is either disposed of or discharged or otherwise allowed to flow into a watercourse, lake, or other body of state-owned water.

Water conservation plan – A strategy or combination of strategies for reducing the volume of water withdrawn from a water supply source, for reducing the loss or waste of water, for maintaining or improving the efficiency in the use of water, for increasing the recycling and reuse of water, and for preventing the pollution of water. A water conservation plan may be a separate document identified as such or may be contained within another water management document(s).

Water loss - The difference between water diverted or treated and water delivered (sold). Water loss can result from:

1. inaccurate or incomplete record keeping;
2. meter error;
3. unmetered uses such as firefighting, line flushing, and water for public buildings and water treatment plants;
4. leaks; and
5. water theft and unauthorized use.

Wholesale public water supplier – An individual or entity that for compensation supplies water to another for resale to the public for human consumption. The term does not include an individual or entity that supplies water to itself or its employees or tenants as an incident of that employee service or tenancy when that water is not resold to or used by others, or an individual or entity that conveys water to another individual or entity, but does not own the right to the water which is conveyed, whether or not for a delivery fee.

Texas Commission on Environmental Quality

PROFILE & WATER CONSERVATION PLAN REQUIREMENTS FOR WHOLESALE PUBLIC WATER SUPPLIERS

This form is provided to assist wholesale public water suppliers in water conservation plan development. Information from this form should be included within a wholesale public water supplier water conservation plan. If you need assistance in completing this form or in developing your plan, please contact the conservation staff of the Resource Protection Team in the Water Supply Division at (512) 239-4691.

Name of Entity: ____

Address & Zip: ____

Telephone Number: ______________________________ **Fax:** ____________________

Form Completed By: ____

Title: ____

Signature: ______________________________ **Date:** ___________________

Name and Phone Number of Person/Department responsible for implementing a water conservation program: ____

PROFILE

I. WHOLESALE SERVICE AREA POPULATION AND CUSTOMER DATA

A. Population and Service Area Data

1. Service area size in square miles: ______________________________
(attach a copy of service-area map)

2. Current population of service area: ______________________________

3. Current population served for:

a. water ______________________
b. wastewater ______________________

4. Population served for previous five years:

Year	Population
________	________
________	________
________	________
________	________
________	________

5. Projected population for service area in the following decades:

Year	Population
2010	________
2020	________
2030	________
2040	________
2050	________

6. List source or method for the calculation of current and projected population:

____
____
____
____

B. Customers Data

List (or attach) the names of all wholesale customers, amount of annual contract, and amount of the annual use for each for the previous year:

	Wholesale Customer	Contracted Amount (acre-feet)	Previous Year Amount of Water Delivered (acre-feet)
(1)	____________	____________	____________
(2)	____________	____________	____________
(3)	____________	____________	____________
(4)	____________	____________	____________
(5)	____________	____________	____________

II. WATER USE DATA FOR SERVICE AREA

A. Water Delivery

Indicated if the water provided under wholesale contracts is treated or raw water and the annual amount for each for previous year:

	Total amount delivered or sold for previous year (acre-feet)
Treated	____________________
Raw	____________________

B. Water Accounting Data

1. Total amount of water diverted at point of diversion(s) for previous five years (in acre-feet) for all water uses:

Year	________	________	________	________	________
January	________	________	________	________	________
February	________	________	________	________	________
March	________	________	________	________	________
April	________	________	________	________	________
May	________	________	________	________	________
June	________	________	________	________	________
July	________	________	________	________	________
August	________	________	________	________	________
September	________	________	________	________	________
October	________	________	________	________	________
November	________	________	________	________	________
December	________	________	________	________	________
Total	________	________	________	________	________

2. Wholesale population served and total amount of water diverted for **municipal use** for previous five years:

Year	Total Population Served	Total Annual Water Diverted for Municipal Use (acre feet)
________	________________	________________
________	________________	________________
________	________________	________________
________	________________	________________
________	________________	________________

C. Projected Water Demands

If applicable, project and attach water supply demands for the next ten years using information such as population trends, historical water use, and economic growth in the service area over the next ten years and any additional water supply requirement from such growth.

III. WATER SUPPLY SYSTEM DATA

A. Water Supply Sources

List all current water supply sources and the amounts authorized with each:

	Source	Amount Authorized
Surface Water:	________________________________	_____________ acre-feet
Groundwater:	________________________________	_____________ acre-feet
Other:	________________________________	_____________ acre-feet

B. Treatment and Distribution System (if provide treated water)

1. Design daily capacity of system: _______________ MGD

2. Storage Capacity: Elevated ________ MGD, Ground _______ MGD

3. Please describe the water system and attach. Include the number of treatment plants, wells, and storage tanks. If possible, attach a sketch of the system layout.

IV. WASTEWATER SYSTEM DATA

A. Wastewater System Data (if applicable)

1. Design capacity of wastewater treatment plant(s): ___________ MGD

2. Briefly describe the wastewater system(s) of the area serviced by the wholesale public water supplier. Describe how treated wastewater is disposed of. Where applicable, identify treatment plant(s) with the TCEQ name and number, the operator, owner, and, if wastewater is discharged, the receiving stream. If possible, attach a sketch or map which locates the plant(s) and discharge points or disposal sites.

B. Wastewater Data for Service Area (if applicable)

1. Percent of water service area served by wastewater system: ______%

2. Monthly volume treated for previous three years (in 1,000 gallons):

Year			
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			
Total			

REQUIREMENTS FOR WATER CONSERVATION PLANS FOR WHOLESALE PUBLIC WATER SUPPLIERS

In addition to the description of the wholesaler's service area (profile from above), a water conservation plan for a wholesale public water supplier must include, at a minimum, additional information as required by Title 30, Texas Administrative Code, §288.5. Note: If the water conservation plan does not provide information for each requirement, an explanation must be included as to why the requirement is not applicable.

Specific, Quantified 5 & 10-Year Targets

The water conservation plan must include specific, quantified five-year and ten-year targets for water savings including, where appropriate, target goals for municipal use in gallons per capita per day for the wholesaler's service area, maximum acceptable unaccounted-for water, and the basis for the development of these goals. Note that the goals established by wholesale water suppliers under this subparagraph are not enforceable.

Metering Devices

The water conservation plan must include a description as to which practice(s) and/or device(s) will be utilized to measure and account for the amount of water diverted from the source(s) of supply.

Record Management Program

The water conservation plan must include a monitoring and record management program for determining water deliveries, sales, and losses.

Metering/Leak-Detection and Repair Program

The water conservation plan must include a program of metering and leak detection and repair for the wholesaler's water storage, delivery, and distribution system.

Reservoir Systems Operations Plan

The water conservation plan must include a reservoir systems operations plan, if applicable, providing for the coordinated operation of reservoirs owned by the applicant within a common watershed or river basin. The reservoir systems operations plans shall include optimization of water supplies as one of the significant goals of the plan.

Contract Requirements for Successive Customer Conservation

The water conservation plan must include a requirement in every water supply contract entered into or renewed after official adoption of the water conservation plan, and including any contract extension, that each successive wholesale customer develop and implement a water conservation plan or water conservation measures using the applicable elements of this chapter. If the customer intends to resell the water, then the contract between the initial supplier and customer must provide that the contract for the resale of the water must have water conservation requirements so that each successive customer in the resale of the water will be required to implement water conservation measures in accordance with the provisions of Title 30 TAC Chapter 288.

Enforcement Procedure & Official Adoption

The water conservation plan must include a means for implementation and enforcement, which shall be evidenced by a copy of the ordinance, rule, resolution, or tariff, indicating official adoption of the water conservation plan by the water supplier; and a description of the authority by which the water supplier will implement and enforce the conservation plan.

Coordination with the Regional Water Planning Group(s)

The water conservation plan must include documentation of coordination with the regional water planning groups for the service area of the wholesale water supplier in order to ensure consistency with the appropriate approved regional water plans.

Example statement to be included within the water conservation plan:

The service area of the _____________ (name of water supplier) is located within the ___________ (name of regional water planning area or areas) and ___________ (name of water supplier) has provided a copy of this water conservation plan to the ____________ (name of regional water planning group or groups).

Plan Review and Update

Beginning May 1, 2005, the wholesale water supplier shall review and update its water conservation plan, as appropriate based on an assessment of previous five-year and ten-year targets and any other new or updated information. A wholesale water supplier shall review and update the next revision of its water conservation plan not later than May 1, 2009, and every five years after that date to coincide with the regional water planning group. The revised plan must also include an implementation report.

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Appendix A

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Irrigation – The agricultural use of water for the irrigation of crops, trees, and pastureland, including, but not limited to, golf courses and parks which do not receive water through a municipal distribution system.

Municipal per capita water use – The sum total of water diverted into a water supply system for residential, commercial, and public and institutional uses divided by actual population served.

Municipal use – The use of potable water within or outside a municipality and its environs whether supplied by a person, privately owned utility, political subdivision, or other entity as well as the use of sewage effluent for certain purposes, including the use of treated water for domestic purposes, fighting fires, sprinkling streets, flushing sewers and drains, watering parks and parkways, and recreational purposes, including public and private swimming pools, the use of potable water in industrial and commercial enterprises supplied by a municipal distribution system without special construction to meet its demands, and for the watering of lawns and family gardens.

Municipal use in gallons per capita per day – The total average daily amount of water diverted or pumped for treatment for potable use by a public water supply system. The calculation is made by dividing the water diverted or pumped for treatment for potable use by population served. Indirect reuse volumes shall be credited against total diversion volumes for the purpose of calculating gallons per capita per day for targets and goals.

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Reuse – The authorized use for one or more beneficial purposes of use of water that remains unconsumed after the water is used for the original purpose of use and before that water is either disposed of or discharged or otherwise allowed to flow into a watercourse, lake, or other body of state-owned water.

Water conservation plan – A strategy or combination of strategies for reducing the volume of water withdrawn from a water supply source, for reducing the loss or waste of water, for maintaining or improving the efficiency in the use of water, for increasing the recycling and reuse of water, and for preventing the pollution of water. A water conservation plan may be a separate document identified as such or may be contained within another water management document(s).

Water loss - The difference between water diverted or treated and water delivered (sold). Water loss can result from:

1. inaccurate or incomplete record keeping;
2. meter error;
3. unmetered uses such as firefighting, line flushing, and water for public buildings and water treatment plants;
4. leaks; and
5. water theft and unauthorized use.

Wholesale public water supplier – An individual or entity that for compensation supplies water to another for resale to the public for human consumption. The term does not include an individual or entity that supplies water to itself or its employees or tenants as an incident of that employee service or tenancy when that water is not resold to or used by others, or an individual or entity that conveys water to another individual or entity, but does not own the right to the water which is conveyed, whether or not for a delivery fee.

Texas Commission on Environmental Quality

INDUSTRIAL/MINING WATER CONSERVATION PLAN

This form is provided to assist entities in conservation plan development for industrial/mining water use. If you need assistance in completing this form or in developing your plan, please contact the conservation staff of the Resource Protection Team in the Water Supply Division at (512) 239-4691.

Name: ______________________________

Address: ______________________________

Telephone Number: ____________________ **Fax:** ____________________

Form Completed By: ______________________________

Title: ______________________________

Signature: ____________________ **Date:** ____________________

NOTE: If the plan does not provide information for each requirement, include an explanation of why the requirement is not applicable.

I. BACKGROUND DATA

A. Water use

1. Annual diversion appropriated or requested (in acre-feet): ____________

2. Maximum diversion rate (cfs): ____________

______B. Water sources______________________________

1. Please indicate the maximum or average annual amounts of water currently used and anticipated to be used (in acre-feet) for industrial/mining purposes:

____________ Source (List water right numbers) Current Use Anticipated Use

___________________Surface water __________ ______ __________
____
___________________Groundwater __________ ______________ __________
____
___________________Purchased __________ __________

___________________**TOTAL** __________ __________

2. How was the surface water data provided above (B1) obtained?

   Master meter ___ ; Customer meter____ ; Estimated ____ ; Other ____
   If other, identify source: ____

3. Was purchased water raw____ or treated ____ ? If both, % raw ____ ,
   % treated ____.
   Supplier(s): ____

4. How was the groundwater data provided above (B1) obtained?

   Master meter____ ; Customer meter____ ; Estimated____ ; Other
   If other, identify source: ____

5. What is the rate and cost of purchased water? Rate ______
   Cost ______

C. Industrial/Mining Information

1. Major product or service produced by applicant:
   ____
   ____

2. Major Standard Industrial Classification Code: __ __ __ __

3. Total number of employees at facility: ______

II. WATER USE AND CONSERVATION PRACTICES

A. Water Use in Industrial or Mining Process:

Production Use	% Groundwater	% Surface Water	% Saline Water	% Treated Water	Water Use (In Acre-Feet)
Cooling, condensing, & refrigeration					

Production Use	% Groundwater	% Surface Water	% Saline Water	% Treated Water	Water Use (In Acre-Feet)
Processing, washing, transport					
Boiler feed					
Incorporated into product					
Other					

Facility Use	% Groundwater	% Surface Water	% Saline Water	% Treated Water	Water Use (In Acre-Feet)
Cooling tower(s)					
Pond(s)					
Once through					
Sanitary & drinking water					
Irrigation & dust control					

1. Was fresh water recirculated at this facility? Yes ____ No ____

2. Was electric power generated at this facility (for in-plant use or for sale)? Yes ____ No ____

3. Description of the above use(s) of water (e.g., if water is being used for cooling, indicate the cooling system: tower, pond, etc.):
____
____
____

4. Describe or illustrate how surface water is diverted and delivered to the point(s) of use, the location of the diversion(s) and points of use, and how diversions are measured:
____

____

____

5. Monthly water demand for previous year (in acre-feet):

	Diversion	Percent of Return Flow	Monthly Demand
January	________	________	________
February	________	________	________
March	________	________	________
April	________	________	________
May	________	________	________
June	________	________	________
July	________	________	________
August	________	________	________
September	________	________	________
October	________	________	________
November	________	________	________
December	________	________	________
TOTAL	________	________	________

6. Projected monthly water demand for next year (in acre-feet):

	Diversion	Return Flow	Percent of Monthly Demand
January	________	________	________
February	________	________	________
March	________	________	________
April	________	________	________
May	________	________	________
June	________	________	________
July	________	________	________
August	________	________	________
September	________	________	________
October	________	________	________
November	________	________	________
December	________	________	________
TOTAL	________	________	________

B. Specific and Quantified Conservation Goal

Water conservation goals for the industrial and mining sector are generally established either for (1) the amount of water recycled, (2) the amount of water reused, or (3) the amount of water not lost or consumed, and therefore is available for return flow.

1. Water conservation goal (water use efficiency measure):

   Type of goal to be used:
   ___ Percent of water reused
   ___ Percent of water not consumed, and therefore returned as flow
   ___ Other (specify)

2. Provide the specific and quantified five-year and ten-year targets for water savings and the basis for development of such goals for this water use/facility:

   ____
____
____
____
____
____

3. Describe the methods and/or device within an accuracy of plus or minus 5% used to measure and account for the amount of water diverted from the source of supply:

   ____
____
____
____
____

4. Leak-detection, repair, and water-loss accounting measures used:

   ____
____
____
____
____

5. Equipment and/or process modifications used to improve water use

efficiency: ____

____
____
____
____

6. Other conservation techniques used: ____

____
____
____
____

III. WASTEWATER USE CHARACTERISTICS

A. Check the type(s) of wastewater disposal system(s) used at this facility:

On-site wastewater plant ____
Septic tank(s) ____
Injection well(s) ____
City or regional wastewater system ____
Other ____ (Please identify)

B. What quantity of fresh water was consumed, and therefore not returned to a wastewater treatment system (public or private), or to a water course (including loss to product, evaporation, injection, etc.)?

____
____
____

IV. ADDITIONAL COMMENTS/INFORMATION

Please provide any additional information that may indicate the present and future water needs at this facility, and any water problems.

Best Management Practices Guide

On November 2004, the Texas Water Development Board's (TWDB) Report 362 was completed by the Water Conservation Implementation Task Force. Report 362 is the Water Conservation Best Management Practices (BMP) Guide. The BMP Guide is a voluntary list of management practices that water users may implement in addition to the required components of Title 30, Texas Administrative Code, Chapter 288. The BMP Guide is available on the TWDB's website at the link below or by calling (512) 463-7847.

http://www.twdb.state.tx.us/assistance/conservation/TaskForceDocs/WCITFBMPGuide.pdf

Texas Commission on Environmental Quality

SYSTEM INVENTORY AND WATER CONSERVATION PLAN FOR AGRICULTURAL WATER SUPPLIERS PROVIDING WATER TO MORE THAN ONE USER

This form is provided to assist entities in conservation plan development for agricultural water suppliers providing water to more than one user individually-operated irrigation systems. If you need assistance in completing this form or in developing your plan, please contact the conservation staff of the Resource Protection Team in the Water Supply Division at (512) 239-4691.

Name: ____________________

Address: ____________________

Telephone Number: ____________________ **Fax:** ____________________

Form Completed By: ____________________ **Title:** ____________________

Signature: ____________________ **Date:** ____________________

NOTE: If the plan does not provide information for each requirement, include an explanation of why the requirement is not applicable.

I. STRUCTURAL FACILITIES

A. Description of service area: ____________________

B. Total miles of main canals and pipelines: __________

C. Total miles of lateral canals and pipelines: __________

D. Reservoir capacity, if applicable: __________

E. Description of pumps and pumping stations:

____
____

F. Description of meters and/or measuring devices: ____________________

____
____
____

G. Description of customer gates and measuring devices: ____________________

____
____
____

H. Description of canal construction:

a. Miles of unlined canals: __________
b. Miles of lined canals: __________
c. Miles of enclosed pipelines: __________
d. Other: ______________________________________
____
____

I. Description of canal conditions and recent or planned improvements:

____
____
____
____

J. Description of any other structural facilities not covered above:

____
____
____
____

II. MANAGEMENT PRACTICES

A. Total water available to district (in acre-feet/year): ______________________

1. Maximum water rights allocation to district: ______________________

a. Water rights number(s): ______________________

b. Other water contracted to be delivered by district: ___________
____

2. Average annual water diverted by district (in acre-feet/year): __________

3. Average annual water delivered to customers (in a-f/yr.): ___________

4. Delivery efficiency (percentage): ___________

5. Historical diversions and deliveries:

Year	Annual Rainfall (in./yr.)	Total Annual Water Diverted (acre-feet)	Annual Irrigation Water Delivered (acre-feet)	Annual Municipal Water Delivered (acre-feet)	Annual Other Water Delivered (acre-feet)	Total Annual Water Delivered (acre-feet)	Estimated Delivery Efficiency (percentage)
Average							

6. Practices and/or devices used to account for water deliveries:
____
____
____

7. Water pricing policy:
____
____

8. Operating rules and policies which encourage water conservation:

____

____

____

____

9. Other management practices and services provided by the district:

____

____

____

III. USER PROFILE

1. Total number of acres in service area: ____________
2. Average number of acres irrigated annually: ____________
3. Projected number of acres to be irrigated in 10 years: ____________
4. Number of active irrigation customers: ____________
5. Total irrigation water delivered annually (in acre-feet): ____________
6. Types of crops grown by customers:

____

____

____

7. Types of irrigation systems used by customer:

____

____

____

8. Types of drainage systems used by customers:

____

____

____

9. Further description of irrigation customers:

____

____

____

10. List of municipal customers and number of acre-feet allocated annually:

11. List of industrial and other large customers and number of acre-feet allocated annually:

12. Additional information about water users:

IV. Describe **specific and quantified five-year and ten-year targets for water savings** including maximum allowable losses for the storage and distribution system:

V. Describe the practice(s) and/or device(s) which will be utilized to measure and account for the amount of water diverted from the source(s) of supply:

VI. Describe the monitoring and record management program for water deliveries, sales, and losses:

VII. Describe any methods that will be used for water loss control, leak detection, and repair:

VIII. Describe any program for customer assistance in the development of on-farm water conservation and pollution prevention measures:

IX. Describe any other water conservation practice, method, or technique which the supplier shows to be appropriate for achieving conservation (if applicable):

X. Additional requirements:

1. There must be a requirement in every wholesale water supply contract entered into or renewed after official adoption of the plan (by either ordinance, resolution, or tariff), and including any contract extension, that each successive wholesale customer develop and implement a water conservation plan or water conservation measures using the applicable elements in 30 TAC §288; if the customer intends to resell the water, then the contract for the resale of the water must have water conservation requirements so that each successive customer in the resale of the water will be required to implement water conservation measures in accordance with applicable provisions of this chapter.

2. Evidence of official adoption of the water conservation plan and goals, by ordinance, rule, resolution, or tariff, indicating that the plan reflects official policy of the supplier.

3. Documentation of coordination with the Regional Water Planning Groups in order to insure consistency with the appropriate approved regional water plans.

Best Management Practices Guide

On November 2004, the Texas Water Development Board's (TWDB) Report 362 was completed by the Water Conservation Implementation Task Force. Report 362 is the Water Conservation Best Management Practices (BMP) Guide. The BMP Guide is a voluntary list of management practices that water users may implement in addition to the required components of Title 30, Texas Administrative Code, Chapter 288. The BMP Guide is available on the TWDB's website at the link below or by calling (512) 463-7847.

http://www.twdb.state.tx.us/assistance/conservation/TaskForceDocs/WCITFBMPGuide.pdf

ATTACHMENT 6-2

REGIONAL WATER PLANNING GROUP B

MODEL DROUGHT CONTINGENCY PLANS

Drought Contingency Plan
for a Retail Public Water Supplier
Texas Commission on Environmental Quality

Instructions: The following form is a model of a drought contingency plan for a retail public water supplier. Not all items may apply to your system's situation. This form is supplied for your convenience, but you are not required to use this form to submit your plan to the TCEQ. Submit completed plans to: Water Supply Division MC 160, TCEQ, P.O. Box 13087, Austin TX 78711-3087.

____
(Name of Utility)

____
(Address, City, Zip Code)

____
(CCN#)

____
(PWS #s)

____
(Date)

Section I: Declaration of Policy, Purpose, and Intent

In order to conserve the available water supply and protect the integrity of water supply facilities, with particular regard for domestic water use, sanitation, and fire protection, and to protect and preserve public health, welfare, and safety and minimize the adverse impacts of water supply shortage or other water supply emergency conditions, the ___________________ (name of your water supplier) hereby adopts the following regulations and restrictions on the delivery and consumption of water through an ordinance/or resolution (see Appendix C for an example).

Water uses regulated or prohibited under this Drought Contingency Plan (the Plan) are considered to be non-essential and continuation of such uses during times of water shortage or other emergency water supply condition are deemed to constitute a waste of water which subjects the offender(s) to penalties as defined in Section XI of this Plan.

Section II: Public Involvement

Opportunity for the public to provide input into the preparation of the Plan was provided by the ______________ (name of your water supplier) by means of ________________ (describe methods used to inform the public about the preparation of the plan and provide opportunities for input; for example, scheduling and providing public notice of a public meeting to accept input on the Plan).

Section III: Public Education

The ______________ (name of your water supplier) will periodically provide the public with information about the Plan, including information about the conditions under which each stage of the Plan is to be initiated or terminated and the drought response measures to be implemented in each stage. This information will be provided by means of __________________ (describe methods to be used to provide information to the public about the Plan; for example, public events, press releases or utility bill inserts).

Section IV: Coordination with Regional Water Planning Groups

The service area of the _____________ (name of your water supplier) is located within the ____________ (name of regional water planning area or areas) and ___________ (name of your water supplier) has provided a copy of this Plan to the ____________ (name of your regional water planning group or groups).

Section V: Authorization

The ___________________ (designated official; for example, the mayor, city manager, utility director, general manager, etc.), or his/her designee is hereby authorized and directed to implement the applicable provisions of this Plan upon determination that such implementation is necessary to protect public health, safety, and welfare. The _______________, (designated official) or his/her designee, shall have the authority to initiate or terminate drought or other water supply emergency response measures as described in this Plan.

Section VI: Application

The provisions of this Plan shall apply to all persons, customers, and property utilizing water provided by the __________________ (name of your water supplier). The terms "person" and "customer" as used in the Plan include individuals, corporations, partnerships, associations, and all other legal entities.

Section VII: Definitions

For the purposes of this Plan**,** the following definitions shall apply:

Aesthetic water use: water use for ornamental or decorative purposes such as fountains, reflecting pools, and water gardens.

Commercial and institutional water use: water use which is integral to the operations of commercial and non-profit establishments and governmental entities such as retail establishments, hotels and motels, restaurants, and office buildings.

Conservation: those practices, techniques, and technologies that reduce the consumption of water, reduce the loss or waste of water, improve the efficiency in the use of water or increase the recycling and reuse of water so that a supply is conserved and made available for future or alternative uses.

Customer: any person, company, or organization using water supplied by _________________ (name of your water supplier).

Domestic water use: water use for personal needs or for household or sanitary purposes such as drinking, bathing, heating, cooking, sanitation, or for cleaning a residence, business, industry, or institution.

Even number address: street addresses, box numbers, or rural postal route numbers ending in 0, 2, 4, 6, or 8 and locations without addresses.

Industrial water use: the use of water in processes designed to convert materials of lower value into forms having greater usability and value.

Landscape irrigation use: water used for the irrigation and maintenance of landscaped areas, whether publicly or privately owned, including residential and commercial lawns, gardens, golf courses, parks, and rights-of-way and medians.

Non-essential water use: water uses that are not essential nor required for the protection of public, health, safety, and welfare, including:

(a) irrigation of landscape areas, including parks, athletic fields, and golf courses, except otherwise provided under this Plan;
(b) use of water to wash any motor vehicle, motorbike, boat, trailer, airplane or other vehicle;
(c) use of water to wash down any sidewalks, walkways, driveways, parking lots, tennis courts, or other hard-surfaced areas;
(d) use of water to wash down buildings or structures for purposes other than immediate fire protection;
(e) flushing gutters or permitting water to run or accumulate in any gutter or street;
(f) use of water to fill, refill, or add to any indoor or outdoor swimming pools or jacuzzi-type pools;

(g) use of water in a fountain or pond for aesthetic or scenic purposes except where necessary to support aquatic life;
(h) failure to repair a controllable leak(s) within a reasonable period after having been given notice directing the repair of such leak(s); and
(i) use of water from hydrants for construction purposes or any other purposes other than fire fighting.

Odd numbered address: street addresses, box numbers, or rural postal route numbers ending in 1, 3, 5, 7, or 9.

Section VIII: Criteria for Initiation and Termination of Drought Response Stages

The ________________ (designated official) or his/her designee shall monitor water supply and/or demand conditions on a __________ (example: daily, weekly, monthly) basis and shall determine when conditions warrant initiation or termination of each stage of the Plan, that is, when the specified "triggers" are reached.

The triggering criteria described below are based on _____________________________________
____
(*provide a brief description of the rationale for the triggering criteria; for example, triggering criteria / trigger levels based on a statistical analysis of the vulnerability of the water source under drought of record conditions, or based on known system capacity limits*).

Stage 1 Triggers – MILD Water Shortage Conditions

Requirements for initiation
Customers shall be requested to voluntarily conserve water and adhere to the prescribed restrictions on certain water uses, defined in Section VII–Definitions, when

____
(*describe triggering criteria / trigger levels; see examples below*).

Following are examples of the types of triggering criteria that might be used in one or more successive stages of a drought contingency plan. One or a combination of such criteria must be defined for each drought response stage, but usually not all will apply. Select those appropriate to your system:

Example 1: Annually, beginning on May 1 through September 30.

Example 2: When the water supply available to the _______ (name of your water supplier) is equal to or less than _______ (acre-feet, percentage of storage, etc.).

Example 3: When, pursuant to requirements specified in the _____________(name of ***your*** *water supplier) wholesale water purchase contract with ____________ (name* *of your wholesale water supplier), notification is received requesting initiation of Stage 1 of the Drought Contingency Plan.*

Example 4: *When flows in the _______ (name of stream or river) are equal to or less than ____cubic feet per second.*

Example 5: *When the static water level in the ____________ (name of your water supplier) well(s) is equal to or less than _____feet above/below mean sea level.*

Example 6: *When the specific capacity of the __________________ (name of your water supplier) well(s) is equal to or less than _____ percent of the well's original specific capacity.*

Example 7: *When total daily water demand equals or exceeds ______ million gallons for ___consecutive days of ____ million gallons on a single day (example: based on the "safe" operating capacity of water supply facilities).*

Example 8: *Continually falling treated water reservoir levels which do not refill above __ percent overnight (example: based on an evaluation of minimum treated water storage required to avoid system outage).*

The public water supplier may devise other triggering criteria which are tailored to its system.

Requirements for termination
Stage 1 of the Plan may be rescinded when all of the conditions listed as triggering events have ceased to exist for a period of ___ (e.g. 3) consecutive days.

Stage 2 Triggers -- MODERATE Water Shortage Conditions

Requirements for initiation
Customers shall be required to comply with the requirements and restrictions on certain non-essential water uses provided in Section IX of this Plan when ____________ (*describe triggering criteria; see examples in Stage 1*).

Requirements for termination
Stage 2 of the Plan may be rescinded when all of the conditions listed as triggering events have ceased to exist for a period of ___ (example: 3) consecutive days. Upon termination of Stage 2, Stage 1 becomes operative.

Stage 3 Triggers – SEVERE Water Shortage Conditions

Requirements for initiation
Customers shall be required to comply with the requirements and restrictions on certain non-essential water uses for Stage 3 of this Plan when ____________ (*describe triggering criteria; see examples in*

Stage 1).

Requirements for termination
Stage 3 of the Plan may be rescinded when all of the conditions listed as triggering events have ceased to exist for a period of ___ (example: 3) consecutive days. Upon termination of Stage 3, Stage 2 becomes operative.

Stage 4 Triggers -- CRITICAL Water Shortage Conditions

Requirements for initiation
Customers shall be required to comply with the requirements and restrictions on certain non-essential water uses for Stage 4 of this Plan when ____________ (*describe triggering criteria; see examples in Stage 1*).

Requirements for termination
Stage 4 of the Plan may be rescinded when all of the conditions listed as triggering events have ceased to exist for a period of ___ (example: 3) consecutive days. Upon termination of Stage 4, Stage 3 becomes operative.

Stage 5 Triggers -- EMERGENCY Water Shortage Conditions

Requirements for initiation
Customers shall be required to comply with the requirements and restrictions for Stage 5 of this Plan when ____________ (designated official), or his/her designee, determines that a water supply emergency exists based on:

1. Major water line breaks, or pump or system failures occur, which cause unprecedented loss of capability to provide water service; **or**

2. Natural or man-made contamination of the water supply source(s).

Requirements for termination
Stage 5 of the Plan may be rescinded when all of the conditions listed as triggering events have ceased to exist for a period of ___ (example: 3) consecutive days.

Stage 6 Triggers -- WATER ALLOCATION

Requirements for initiation
Customers shall be required to comply with the water allocation plan prescribed in Section IX of this Plan and comply with the requirements and restrictions for Stage 5 of this Plan when ____________ (describe triggering criteria, see examples in Stage 1).

Requirements for termination - Water allocation may be rescinded when all of the conditions listed as triggering events have ceased to exist for a period of ___ (example: 3) consecutive days.

> *Note: The inclusion of WATER ALLOCATION as part of a drought contingency plan may not be required in all cases. For example, for a given water supplier, an analysis of water supply availability under drought of record conditions may indicate that there is essentially no risk of water supply shortage. Hence, a drought contingency plan for such a water supplier might only address facility capacity limitations and emergency conditions (example: supply source contamination and system capacity limitations).*

Section IX: Drought Response Stages

The _______________ (designated official), or his/her designee, shall monitor water supply and/or demand conditions on a daily basis and, in accordance with the triggering criteria set forth in Section VIII of this Plan, shall determine that a mild, moderate, severe, critical, emergency or water shortage condition exists and shall implement the following notification procedures:

Notification

Notification of the Public:
The _________ (designated official) or his/ her designee shall notify the public by means of:

Examples:
publication in a newspaper of general circulation,
direct mail to each customer,
public service announcements,
signs posted in public places
take-home fliers at schools.

Additional Notification:
The _________ (designated official) or his/ her designee shall notify directly, or cause to be notified directly, the following individuals and entities:

Examples:
Mayor / Chairman and members of the City Council / Utility Board
Fire Chief(s)
City and/or County Emergency Management Coordinator(s)
County Judge & Commissioner(s)
State Disaster District / Department of Public Safety
TCEQ *(required when* mandatory *restrictions are imposed)*
Major water users

Critical water users, i.e. hospitals
Parks / street superintendents & public facilities managers

Note: The plan should specify direct notice only as appropriate to respective drought stages.

Stage 1 Response -- MILD Water Shortage Conditions

Target: Achieve a voluntary ___ percent reduction in __________(example: total water use, daily water demand, etc.).

Best Management Practices for Supply Management:

D*escribe additional measures, if any, to be implemented directly by (name of your water supplier) to manage limited water supplies and/or reduce water demand. Examples include: reduced or discontinued flushing of water mains, activation and use of an alternative supply source(s); use of reclaimed water for non-potable purposes.*

Voluntary Water Use Restrictions for Reducing Demand :

(a) Water customers are requested to voluntarily limit the irrigation of landscaped areas to Sundays and Thursdays for customers with a street address ending in an even number (0, 2, 4, 6 or 8), and Saturdays and Wednesdays for water customers with a street address ending in an odd number (1, 3, 5, 7 or 9), and to irrigate landscapes only between the hours of midnight and 10:00 a.m. and 8:00 p.m to midnight on designated watering days.

(b) All operations of the ______________ (name of your water supplier) shall adhere to water use restrictions prescribed for Stage 2 of the Plan.

(c) Water customers are requested to practice water conservation and to minimize or discontinue water use for non-essential purposes.

Stage 2 Response -- MODERATE Water Shortage Conditions

Target: Achieve a ___ percent reduction in __________ (example: total water use, daily water demand, etc.).

Best Management Practices for Supply Management:

Describe additional measures, if any, to be implemented directly by ____________ (name of your water supplier) to manage limited water supplies and/or reduce water demand. Examples include: reduced or discontinued flushing of water mains, reduced or discontinued irrigation of public landscaped areas; use of an alternative supply source(s); use of reclaimed water for non-potable purposes.

Water Use Restrictions for Demand Reduction:
Under threat of penalty for violation, the following water use restrictions shall apply to all persons:

(a) Irrigation of landscaped areas with hose-end sprinklers or automatic irrigation systems shall be limited to Sundays and Thursdays for customers with a street address ending in an even number (0, 2, 4, 6 or 8), and Saturdays and Wednesdays for water customers with a street address ending in an odd number (1, 3, 5, 7 or 9), and irrigation of landscaped areas is further limited to the hours of 12:00 midnight until 10:00 a.m. and between 8:00 p.m. and 12:00 midnight on designated watering days. However, irrigation of landscaped areas is permitted at anytime if it is by means of a hand-held hose, a faucet filled bucket or watering can of five (5) gallons or less, or drip irrigation system.

(b) Use of water to wash any motor vehicle, motorbike, boat, trailer, airplane or other vehicle is prohibited except on designated watering days between the hours of 12:00 midnight and 10:00 a.m. and between 8:00 p.m. and 12:00 midnight. Such washing, when allowed, shall be done with a hand-held bucket or a hand-held hose equipped with a positive shutoff nozzle for quick rises. Vehicle washing may be done at any time on the immediate premises of a commercial car wash or commercial service station. Further, such washing may be exempted from these regulations if the health, safety, and welfare of the public is contingent upon frequent vehicle cleansing, such as garbage trucks and vehicles used to transport food and perishables.

(c) Use of water to fill, refill, or add to any indoor or outdoor swimming pools, wading pools, or jacuzzi-type pools is prohibited except on designated watering days between the hours of 12:00 midnight and 10:00 a.m. and between 8 p.m. and 12:00 midnight.

(d) Operation of any ornamental fountain or pond for aesthetic or scenic purposes is prohibited except where necessary to support aquatic life or where such fountains or ponds are equipped with a recirculation system.

(e) Use of water from hydrants shall be limited to fire fighting, related activities, or other activities necessary to maintain public health, safety, and welfare, except that use of water from designated fire hydrants for construction purposes may be allowed under special permit from the ___________________ (name of your water supplier).

(f) Use of water for the irrigation of golf course greens, tees, and fairways is prohibited except on designated watering days between the hours 12:00 midnight and 10:00 a.m. and between 8 p.m. and 12:00 midnight. However, if the golf course utilizes a water source other than that provided by the _______________ (name of your water supplier), the facility shall not be subject to these regulations.

(g) All restaurants are prohibited from serving water to patrons except upon request of the patron.

(h) The following uses of water are defined as non-essential and are prohibited:

1. wash down of any sidewalks, walkways, driveways, parking lots, tennis courts, or other hard-surfaced areas;
2. use of water to wash down buildings or structures for purposes other than immediate fire protection;
3. use of water for dust control;
4. flushing gutters or permitting water to run or accumulate in any gutter or street; and
5. failure to repair a controllable leak(s) within a reasonable period after having been given notice directing the repair of such leak(s).

Stage 3 Response -- SEVERE Water Shortage Conditions

<u>Target</u>: Achieve a ___ percent reduction in _________ (example: total water use, daily water demand, etc.).

<u>Best Management Practices for Supply Management</u>:

Describe additional measures, if any, to be implemented directly by ____________ (name of your water supplier) to manage limited water supplies and/or reduce water demand. Examples include: reduced or discontinued flushing of water mains, reduced or discontinued irrigation of public landscaped areas; use of an alternative supply source(s); use of reclaimed water for non-potable purposes.

<u>Water Use Restrictions for Demand Reduction</u>:
All requirements of Stage 2 shall remain in effect during Stage 3 except:

(a) Irrigation of landscaped areas shall be limited to designated watering days between the hours of 12:00 midnight and 10:00 a.m. and between 8 p.m. and 12:00 midnight and shall be by means of hand-held hoses, hand-held buckets, drip irrigation, or permanently installed automatic sprinkler system only. The use of hose-end sprinklers is prohibited at all times.

(b) The watering of golf course tees is prohibited unless the golf course utilizes a water source other than that provided by the ____________________ (name of your water supplier).

(c) The use of water for construction purposes from designated fire hydrants under special permit is to be discontinued.

Stage 4 Response -- CRITICAL Water Shortage Conditions

Target: Achieve a ___ percent reduction in _________ (example: total water use, daily water demand, etc.).

Best Management Practices for Supply Management:

Describe additional measures, if any, to be implemented directly by ____________ (name of your water supplier) to manage limited water supplies and/or reduce water demand. Examples include: reduced or discontinued flushing of water mains, reduced or discontinued irrigation of public landscaped areas; use of an alternative supply source(s); use of reclaimed water for non-potable purposes.

Water Use Restrictions for Reducing Demand:. All requirements of Stage 2 and 3 shall remain in effect during Stage 4 except:

(a) Irrigation of landscaped areas shall be limited to designated watering days between the hours of 6:00 a.m. and 10:00 a.m. and between 8:00 p.m. and 12:00 midnight and shall be by means of hand-held hoses, hand-held buckets, or drip irrigation only. The use of hose-end sprinklers or permanently installed automatic sprinkler systems are prohibited at all times.

(b) Use of water to wash any motor vehicle, motorbike, boat, trailer, airplane or other vehicle not occurring on the premises of a commercial car wash and commercial service stations and not in the immediate interest of public health, safety, and welfare is prohibited. Further, such vehicle washing at commercial car washes and commercial service stations shall occur only between the hours of 6:00 a.m. and 10:00 a.m. and between 6:00 p.m. and 10 p.m.

(c) The filling, refilling, or adding of water to swimming pools, wading pools, and jacuzzi-type pools is prohibited.

(d) Operation of any ornamental fountain or pond for aesthetic or scenic purposes is prohibited except where necessary to support aquatic life or where such fountains or ponds are equipped with a recirculation system.

(e) No application for new, additional, expanded, or increased-in-size water service connections, meters, service lines, pipeline extensions, mains, or water service facilities of any kind shall be approved, and time limits for approval of such applications are hereby suspended for such time as this drought response stage or a higher-numbered stage shall be in effect.

Stage 5 Response -- EMERGENCY Water Shortage Conditions

Target: Achieve a ___ percent reduction in _________ (example: total water use, daily water demand, etc.).

Best Management Practices for Supply Management:

Describe additional measures, if any, to be implemented directly by ___________ (name of your water supplier) to manage limited water supplies and/or reduce water demand. Examples include: reduced or discontinued flushing of water mains, reduced or discontinued irrigation of public landscaped areas; use of an alternative supply source(s); use of reclaimed water for non-potable purposes.

Water Use Restrictions for Reducing Demand. All requirements of Stage 2, 3, and 4 shall remain in effect during Stage 5 except:

(a) Irrigation of landscaped areas is absolutely prohibited.

(b) Use of water to wash any motor vehicle, motorbike, boat, trailer, airplane or other vehicle is absolutely prohibited.

Stage 6 Response -- WATER ALLOCATION

In the event that water shortage conditions threaten public health, safety, and welfare, the ___________ (designated official) is hereby authorized to allocate water according to the following water allocation plan:

Single-Family Residential Customers

The allocation to residential water customers residing in a single-family dwelling shall be as follows:

Persons per Household	**Gallons per Month**
1 or 2	6,000
3 or 4	7,000
5 or 6	8,000
7 or 8	9,000
9 or 10	10,000
11 or more	12,000

“Household” means the residential premises served by the customer’s meter. “Persons per household” includes only those persons currently physically residing at the premises and expected to reside there for the entire billing period. It shall be assumed that a particular customer’s household is comprised of two (2) persons unless the customer notifies the ____________ (name of your water supplier) of a greater number of persons per household on a form prescribed by the ____________ designated official). The _________ (designated official) shall give his/her best effort to see that such forms are mailed, otherwise provided, or made available to every residential customer. If, however, a customer does not receive such a

form, it shall be the customer’s responsibility to go to the ____________ (name of your water supplier) offices to complete and sign the form claiming more than two (2) persons per household. New customers may claim more persons per household at the time of applying for water service on the form prescribed by the __________ (designated official). When the number of persons per household increases so as to place the customer in a different allocation category, the customer may notify the _________ (name of water supplier) on such form and the change will be implemented in the next practicable billing period. If the number of persons in a household is reduced, the customer shall notify the _________(name of your water supplier) in writing within two (2) days. In prescribing the method for claiming more than two (2) persons per household, the _________ (designated official) shall adopt methods to insure the accuracy of the claim. Any person who knowingly, recklessly, or with criminal negligence falsely reports the number of persons in a household or fails to timely notify the ____________ (name of your water supplier) of a reduction in the number of person in a household shall be fined not less than $________.

Residential water customers shall pay the following surcharges:

$____ for the first 1,000 gallons over allocation.
$____ for the second 1,000 gallons over allocation.
$____ for the third 1,000 gallons over allocation.
$____ for each additional 1,000 gallons over allocation.

Surcharges shall be cumulative.

Master-Metered Multi-Family Residential Customers

The allocation to a customer billed from a master meter which jointly measures water to multiple permanent residential dwelling units (example: apartments, mobile homes) shall be allocated 6,000 gallons per month for each dwelling unit. It shall be assumed that such a customer’s meter serves two dwelling units unless the customer notifies the ____________ (name of your water supplier) of a greater number on a form prescribed by the __________ (designated official). The _________ (designated official) shall give his/her best effort to see that such forms are mailed, otherwise provided, or made available to every such customer. If, however, a customer does not receive such a form, it shall be the customer's responsibility to go to the ___________ (name of your water supplier) offices to complete and sign the form claiming more than two (2) dwellings. A dwelling unit may be claimed under this provision whether it is occupied or not. New customers may claim more dwelling units at the time of applying for water service on the form prescribed by the __________ (designated official). If the number of dwelling units served by a master meter is reduced, the customer shall notify the _________(name of your water supplier) in writing within two (2) days. In prescribing the method for claiming more than two (2) dwelling units, the _________ (designated official) shall adopt methods to insure the accuracy of the claim. Any person who knowingly, recklessly, or with criminal negligence falsely reports the number of dwelling units served by a master meter or fails to timely notify the ___________ (name of your water supplier) of a reduction in the number of person in a household shall be fined not less than $________. Customers billed from a master meter under this provision shall pay the following monthly surcharges:

$____ for 1,000 gallons over allocation up through 1,000 gallons for each dwelling unit.
$____, thereafter, for each additional 1,000 gallons over allocation up through a second 1,000 gallons for each dwelling unit.
$____, thereafter, for each additional 1,000 gallons over allocation up through a third 1,000 gallons for each dwelling unit.
$ ____, thereafter for each additional 1,000 gallons over allocation.

Surcharges shall be cumulative.

Commercial Customers

A monthly water allocation shall be established by the __________ (designated official), or his/her designee, for each nonresidential commercial customer other than an industrial customer who uses water for processing purposes. The non-residential customer's allocation shall be approximately __ (e.g. 75%) percent of the customer's usage for corresponding month's billing period for the previous 12 months. If the customer's billing history is shorter than 12 months, the monthly average for the period for which there is a record shall be used for any monthly period for which no history exists. Provided, however, a customer, __ percent of whose monthly usage is less than ____ gallons, shall be allocated ____ gallons. The _________ (designated official) shall give his/her best effort to see that notice of each non-residential customer's allocation is mailed to such customer. If, however, a customer does not receive such notice, it shall be the customer's responsibility to contact the ____________ (name of your water supplier) to determine the allocation. Upon request of the customer or at the initiative of the ___________ (designated official), the allocation may be reduced or increased if, (1) the designated period does not accurately reflect the customer's normal water usage, (2) one nonresidential customer agrees to transfer part of its allocation to another nonresidential customer, or (3) other objective evidence demonstrates that the designated allocation is inaccurate under present conditions. A customer may appeal an allocation established hereunder to the ___________ (designated official or alternatively, a special water allocation review committee). Nonresidential commercial customers shall pay the following surcharges:

Customers whose allocation is _____ gallons through ______ gallons per month:

$____ per thousand gallons for the first 1,000 gallons over allocation.
$____ per thousand gallons for the second 1,000 gallons over allocation.
$____ per thousand gallons for the third 1,000 gallons over allocation.
$____ per thousand gallons for each additional 1,000 gallons over allocation.

Customers whose allocation is ______ gallons per month or more:

___ times the block rate for each 1,000 gallons in excess of the allocation up through 5 percent above allocation.
___ times the block rate for each 1,000 gallons from 5 percent through 10 percent above allocation.
___ times the block rate for each 1,000 gallons from 10 percent through 15 percent above allocation.
___ times the block rate for each 1,000 gallons more than 15 percent above allocation.

The surcharges shall be cumulative. As used herein, "block rate" means the charge to the customer per 1,000 gallons at the regular water rate schedule at the level of the customer's allocation.

Industrial Customers

A monthly water allocation shall be established by the __________ (designated official), or his/her designee, for each industrial customer, which uses water for processing purposes. The industrial customer's allocation shall be approximately __ (example: 90%) percent of the customer's water usage baseline. Ninety (90) days after the initial imposition of the allocation for industrial customers, the industrial customer's allocation shall be further reduced to __ (example: 85%) percent of the customer's water usage baseline. The industrial customer's water use baseline will be computed on the average water use for the ______ month period ending prior to the date of implementation of Stage 2 of the Plan. If the industrial water customer's billing history is shorter than ___ months, the monthly average for the period for which there is a record shall be used for any monthly period for which no billing history exists. The _________ (designated official) shall give his/her best effort to see that notice of each industrial customer's allocation is mailed to such customer. If, however, a customer does not receive such notice, it shall be the customer's responsibility to contact the ____________ (name of your water supplier) to determine the allocation, and the allocation shall be fully effective notwithstanding the lack of receipt of written notice. Upon request of the customer or at the initiative of the __________ (designated official), the allocation may be reduced or increased, (1) if the designated period does not accurately reflect the customer's normal water use because the customer had shutdown a major processing unit for repair or overhaul during the period, (2) the customer has added or is in the process of adding significant additional processing capacity, (3) the customer has shutdown or significantly reduced the production of a major processing unit, (4) the customer has previously implemented significant permanent water conservation measures such that the ability to further reduce water use is limited, (5) the customer agrees to transfer part of its allocation to another industrial customer, or (6) if other objective evidence demonstrates that the designated allocation is inaccurate under present conditions. A customer may appeal an allocation established hereunder to the ___________ (designated official or alternatively, a special water allocation review committee). Industrial customers shall pay the following surcharges:

Customers whose allocation is _____ gallons through _______ gallons per month:

$____ per thousand gallons for the first 1,000 gallons over allocation.
$____ per thousand gallons for the second 1,000 gallons over allocation.
$____ per thousand gallons for the third 1,000 gallons over allocation.
$____ per thousand gallons for each additional 1,000 gallons over allocation.

Customers whose allocation is ______ gallons per month or more:

___ times the block rate for each 1,000 gallons in excess of the allocation up through 5 percent above allocation.
___ times the block rate for each 1,000 gallons from 5 percent through 10 percent above allocation.
___ times the block rate for each 1,000 gallons from 10 percent through 15 percent above allocation.
___ times the block rate for each 1,000 gallons more than 15 percent above allocation.

The surcharges shall be cumulative. As used herein, "block rate" means the charge to the customer per 1,000 gallons at the regular water rate schedule at the level of the customer's allocation.

Section X: Enforcement

(a) No person shall knowingly or intentionally allow the use of water from the _________________ (name of your water supplier) for residential, commercial, industrial, agricultural, governmental, or any other purpose in a manner contrary to any provision of this Plan, or in an amount in excess of that permitted by the drought response stage in effect at the time pursuant to action taken by _____________(designated official), or his/her designee, in accordance with provisions of this Plan.

(b) Any person who violates this Plan is guilty of a misdemeanor and, upon conviction shall be punished by a fine of not less than _______ dollars ($__) and not more than ______ dollars ($__). Each day that one or more of the provisions in this Plan is violated shall constitute a separate offense. If a person is convicted of three or more distinct violations of this Plan, the _____________ (designated official) shall, upon due notice to the customer, be authorized to discontinue water service to the premises where such violations occur. Services discontinued under such circumstances shall be restored only upon payment of a re-connection charge, hereby established at $______, and any other costs incurred by the ___________________ (name of your water supplier) in discontinuing service. In addition, suitable assurance must be given to the ________________ (designated official) that the same action shall not be repeated while the Plan is in effect. Compliance with this plan may also be sought through injunctive relief in the district court.

(c) Any person, including a person classified as a water customer of the ______________ (name of your water supplier), in apparent control of the property where a violation occurs or originates shall be presumed to be the violator, and proof that the violation occurred on the person's property shall constitute a rebuttable presumption that the person in apparent control of the property committed the violation, but any such person shall have the right to show that he/she did not commit the violation. Parents shall be presumed to be responsible for violations of their minor children and proof that a violation, committed by a child, occurred on property within the parents' control shall constitute a rebuttable presumption that the parent committed the violation, but any such parent may be excused if he/she proves that he/she had previously directed the child not to use the water as it was used in violation of this Plan and that the parent could not have reasonably known of the violation.

(d) Any employee of the _______________ (name of your water supplier), police officer, or other _____ employee designated by the ___________ (designated official), may issue a citation to a person he/she reasonably believes to be in violation of this Ordinance. The citation shall be prepared in duplicate and shall contain the name and address of the alleged violator, if known, the offense charged, and shall direct him/her to appear in the _____________ (example: municipal court) on the date shown on the citation for which the date shall not be less than 3 days nor more than 5 days from the date the citation was issued. The alleged violator shall be served a copy of the citation. Service of the citation shall be complete upon delivery of the citation to the alleged violator, to an agent or employee of a violator, or to a person over 14 years of age who is a member of the violator's immediate family or is a resident of the violator's residence. The alleged violator shall appear in _________ (example: municipal court) to enter a plea of guilty or not guilty for the violation of this Plan. If the alleged violator fails to appear in __________ (example: municipal court), a warrant for his/her arrest may be issued. A summons to appear may be issued in lieu of an arrest warrant. These cases shall be expedited and given preferential setting in __________ (example: municipal court) before all other cases.

Section XI: Variances

The ________________ (designated official), or his/her designee, may, in writing, grant temporary variance for existing water uses otherwise prohibited under this Plan if it is determined that failure to grant such variance would cause an emergency condition adversely affecting the health, sanitation, or fire protection for the public or the person requesting such variance and if one or more of the following conditions are met:

(a) Compliance with this Plan cannot be technically accomplished during the duration of the water supply shortage or other condition for which the Plan is in effect.
(b) Alternative methods can be implemented which will achieve the same level of reduction in water use.

Persons requesting an exemption from the provisions of this Ordinance shall file a petition for variance with the _________________ (name of your water supplier) within 5 days after the Plan or a particular drought response stage has been invoked. All petitions for variances shall be reviewed by the __________ (designated official), or his/her designee, and shall include the following:

(a) Name and address of the petitioner(s).
(b) Purpose of water use.
(c) Specific provision(s) of the Plan from which the petitioner is requesting relief.
(d) Detailed statement as to how the specific provision of the Plan adversely affects the petitioner or what damage or harm will occur to the petitioner or others if petitioner complies with this Ordinance.
(e) Description of the relief requested.
(f) Period of time for which the variance is sought.
(g) Alternative water use restrictions or other measures the petitioner is taking or proposes to take to meet the intent of this Plan and the compliance date.
(h) Other pertinent information.

Drought Contingency Plan
for a Wholesale Public Water Supplier

Texas Commission on Environmental Quality

Instructions: The following form is a model of a drought contingency plan for a wholesale public water supplier. Not all items may apply to your system's situation. This form is supplied for your convenience, but you are not required to use this form to submit your plan to the TCEQ. Submit completed plans to: Water Supply Division MC 160, TCEQ, P.O. Box 13087, Austin TX 78711-3087.

____

(Name of Utility)

____

(Address, City, Zip Code)

____

(CCN#)

____

(PWS #s)

____

(Date)

Section I: Declaration of Policy, Purpose, and Intent

In order to conserve the available water supply and/or to protect the integrity of water supply facilities, with particular regard for domestic water use, sanitation, and fire protection, and to protect and preserve public health, welfare, and safety and minimize the adverse impacts of water supply shortage or other water supply emergency conditions, the ____________________ (name of your water supplier) adopts the following Drought Contingency Plan (the Plan).

Section II: Public Involvement

Opportunity for the public and wholesale water customers to provide input into the preparation of the Plan was provided by ______________ (name of your water supplier) by means of ______________ (describe methods used to inform the public and wholesale customers about the preparation of the plan and opportunities for input; for example, scheduling and proving public notice of a public meeting to accept input on the Plan).

Section III: Wholesale Water Customer Education

The ____________ (name of your water supplier) will periodically provide wholesale water customers with information about the Plan, including information about the conditions under which each stage of the Plan is to be initiated or terminated and the drought response measures to be implemented in each stage. This information will be provided by means of __________________ (e.g., describe methods to be used to provide customers with information about the Plan; for example, providing a copy of the Plan or periodically including information about the Plan with invoices for water sales).

Section IV: Coordination with Regional Water Planning Groups

The water service area of the ______________ (name of your water supplier) is located within the _______________ (name of regional water planning area or areas) and the _____________ (name of your water supplier) has provided a copy of the Plan to the ____________ (name of your regional water planning group or groups).

Section V: Authorization

The ___________________ (designated official; for example, the general manager or executive director), or his/her designee, is hereby authorized and directed to implement the applicable provisions of this Plan upon determination that such implementation is necessary to protect public health, safety, and welfare. The _______________, or his/her designee, shall have the authority to initiate or terminate drought or other water supply emergency response measures as described in this Plan.

Section VI: Application

The provisions of this Plan shall apply to all customers utilizing water provided by the __________________ (name of your water supplier). The terms "person" and "customer" as used in the Plan include individuals, corporations, partnerships, associations, and all other legal entities.

Section VII: Criteria for Initiation and Termination of Drought Response Stages

The ____________ (designated official), or his/her designee, shall monitor water supply and/or demand conditions on a (e.g., weekly, monthly) basis and shall determine when conditions warrant initiation or termination of each stage of the Plan. Customer notification of the initiation or termination of drought response stages will be made by mail or telephone. The news media will also be informed.

The triggering criteria described below are based on:
____
____ (provide a brief description of the rationale for the triggering criteria; for example, triggering criteria are based on a statistical analysis of the vulnerability *of the water source under drought of record conditions).*

Stage 1 Trggers -- MILD Water Shortage Conditions

Requirements for initiation – The _____________ (name of your water supplier) will recognize that a mild water shortage condition exists when______________(*describe triggering criteria, see examples below).*

Below are examples of the types of triggering criteria that might be used in a wholesale water supplier's drought contingency plan. One or a combination of such criteria may be defined for each drought response stage:

Example 1: ***Water in storage in the _________ (name of reservoir) is equal to or less than _______ (acre-feet and/or percentage of storage capacity).***

Example 2: ***When the combined storage in the __________ (name of reservoirs) is equal to or less than ______ (acre-feet and/or percentage of storage capacity).***

Example 3: ***Flows as measured by the U.S. Geological Survey gage on the ________ (name of river) near ________, Texas reaches ___ cubic feet per second (cfs).***

Example 4: ***When total daily water demand equals or exceeds ______ million gallons for ___consecutive days or ____ million gallons on a single day.***

Example 5: ***When total daily water demand equals or exceeds ___ percent of the safe operating capacity of ____________ million gallons per day for ___consecutive days or ___ percent on a single day.***

Requirements for termination **-** Stage 1 of the Plan may be rescinded when all of the conditions listed as triggering events have ceased to exist for a period of ___ (e.g., 30) consecutive days. The _________ (name of water supplier) will notify its wholesale customers and the media of the termination of Stage 1 in the same manner as the notification of initiation of Stage 1 of the Plan.

Stage 2 Triggers – MODERATE Water Shortage Conditions

Requirements for initiation – The _____________ (name of your water supplier) will recognize that a moderate water shortage condition exists when______________(describe triggering criteria).

Requirements for termination - Stage 2 of the Plan may be rescinded when all of the conditions listed as triggering events have ceased to exist for a period of ___ (e.g., 30) consecutive days. Upon termination of Stage 2, Stage 1 becomes operative. The _________ (name of your water supplier) will notify its wholesale customers and the media of the termination of Stage 2 in the same manner as the notification of initiation of Stage 1 of the Plan.

Stage 3 Triggers -- SEVERE Water Shortage Conditions

Requirements for initiation – The _____________ (name of your water supplier) will recognize that a severe water shortage condition exists when______________(*describe triggering criteria; see examples in Stage 1*).

Requirements for termination - Stage 3 of the Plan may be rescinded when all of the conditions listed as triggering events have ceased to exist for a period of ___ (e.g., 30) consecutive days. Upon termination of Stage 3, Stage 2 becomes operative. The _________ (name of your water supplier) will notify its wholesale customers and the media of the termination of Stage 2 in the same manner as the notification of initiation of Stage 3 of the Plan.

Stage 4 Triggers -- CRITICAL Water Shortage Conditions

Requirements for initiation - The _____________ (name of your water supplier) will recognize that an emergency water shortage condition exists when______________(*describe triggering criteria*; *see examples below*).

Example 1. ***Major water line breaks, or pump or system failures occur, which cause unprecedented loss of capability to provide water service; or***

Example 2. ***Natural or man-made contamination of the water supply source(s).***

Requirements for termination - Stage 4 of the Plan may be rescinded when all of the conditions listed as triggering events have ceased to exist for a period of ___ (e.g., 30) consecutive days. The _________ (name of your water supplier) will notify its wholesale customers and the media of the termination of Stage 4.

Section VIII: Drought Response Stages

The _________ (designated official), or his/her designee, shall monitor water supply and/or demand conditions and, in accordance with the triggering criteria set forth in Section VI, shall determine that mild, moderate, or severe water shortage conditions exist or that an emergency condition exists and shall implement the following actions:

Stage 1 Response -- MILD Water Shortage Conditions

______Target: Achieve a voluntary __ percent reduction in __________ (e.g., total water use, daily water demand, etc.).

______Best Management Practices for Supply Management:

Describe additional measures, if any, to be implemented directly by ____________ (designated official), or his/her designee(s), to manage limited water supplies and/or reduce water demand. Examples include modifying reservoir operations procedures, interconnection with another water system, and use of reclaimed water for non-potable purposes.

Water Use Restrictions for Reducing Demand:

(a) The ________________ (designated official), or his/her designee(s), will contact wholesale water customers to discuss water supply and/or demand conditions and will request that wholesale water customers initiate voluntary measures to reduce water use (e.g., implement Stage 1 of the customer's drought contingency plan).

(b) The _________________ (designated official), or his/her designee(s), will provide a weekly report to news media with information regarding current water supply and/or demand conditions, projected water supply and demand conditions if drought conditions persist, and consumer information on water conservation measures and practices.

Stage 2 Response -- MODERATE Water Shortage Conditions

______Target: Achieve a ___ percent reduction in __________ (e.g., total water use, daily water demand, etc.).

______Best Management Practices for Supply Management:

Describe additional measures, if any, to be implemented directly by ____________ (designated official), or his/her designee(s), to manage limited water supplies and/or reduce water demand. Examples include modifying reservoir operations procedures, *interconnection with another water system, and use of reclaimed water for non-potable purposes.*

Water Use Restrictions for Reducing Demand:

(a) The ________________ (designated official), or his/her designee(s), will initiate weekly contact with wholesale water customers to discuss water supply and/or demand conditions and the possibility of pro rata curtailment of water diversions and/or deliveries.

(b) The ________________ (designated official), or his/her designee(s), will request wholesale water customers to initiate mandatory measures to reduce non-essential water use (e.g., implement Stage 2 of the customer's drought contingency plan).

(c) The _________________ (designated official), or his/her designee(s), will initiate preparations for the implementation of pro rata curtailment of water diversions and/or deliveries by preparing a monthly water usage allocation baseline for each wholesale customer according to the procedures specified in Section VI of the Plan.

(d) The _________________ (designated official), or his/her designee(s), will provide a weekly report to news media with information regarding current water supply and/or demand conditions, projected water supply and demand conditions if drought conditions persist, and consumer information on water conservation measures and practices.

Stage 3 Response -- SEVERE Water Shortage Conditions

<u>Target:</u> Achieve a ___ percent reduction in __________ (e.g., total water use, daily water demand, etc.).

<u>Best Management Practices for Supply Management</u>:

Describe additional measures, if any, to be implemented directly by ____________ (designated official), or his/her designee(s), to manage limited water supplies and/or reduce water demand. Examples include modifying reservoir operations procedures, interconnection with another water system, and use of reclaimed water for non-potable purposes.

Water Use Restrictions for Reducing Demand:

(a) The ________________ (designated official), or his/her designee(s), will contact wholesale water customers to discuss water supply and/or demand conditions and will request that wholesale water customers initiate additional mandatory measures to reduce non-essential water use (e.g., implement Stage 2 of the customer's drought contingency plan).

(b) The _________________ (designated official), or his/her designee(s), will initiate pro rata curtailment of water diversions and/or deliveries for each wholesale customer according to the procedures specified in Section VI of the Plan.

(c) The _________________ (designated official), or his/her designee(s), will provide a weekly report to news media with information regarding current water supply and/or demand conditions, projected water supply and demand conditions if drought conditions persist, and consumer information on water conservation measures and practices.

Stage 4 Response -- EMERGENCY Water Shortage Conditions

Whenever emergency water shortage conditions exist as defined in Section VII of the Plan, the _______________ (designated official) shall:

1. Assess the severity of the problem and identify the actions needed and time required to solve the problem.

2. Inform the utility director or other responsible official of each wholesale water customer by telephone or in person and suggest actions, as appropriate, to alleviate problems (e.g., notification of the public to reduce water use until service is restored).

3. If appropriate, notify city, county, and/or state emergency response officials for assistance.

4. Undertake necessary actions, including repairs and/or clean-up as needed.

5. Prepare a post-event assessment report on the incident and critique of emergency response procedures and actions.

Section IX: Pro Rata Water Allocation

In the event that the triggering criteria specified in Section VII of the Plan for Stage 3 – Severe Water Shortage Conditions have been met, the ____________ (designated official) is hereby authorized initiate allocation of water supplies on a pro rata basis in accordance with Texas Water Code Section 11.039.

Section X: Enforcement

During any period when pro rata allocation of available water supplies is in effect, wholesale customers shall pay the following surcharges on excess water diversions and/or deliveries:

____ times the normal water charge per acre-foot for water diversions and/or deliveries in excess of the monthly allocation up through 5 percent above the monthly allocation.

____ times the normal water charge per acre-foot for water diversions and/or deliveries in excess of the monthly allocation from 5 percent through 10 percent above the monthly allocation.

____ times the normal water charge per acre-foot for water diversions and/or deliveries in excess of the monthly allocation from 10 percent through 15 percent above the monthly allocation.

____ times the normal water charge per acre-foot for water diversions and/or deliveries more than 15 percent above the monthly allocation.

The above surcharges shall be cumulative.

Section XI: Variances

The ________________ (designated official), or his/her designee, may, in writing, grant a temporary variance to the pro rata water allocation policies provided by this Plan if it is determined that failure to grant such variance would cause an emergency condition adversely affecting the public health, welfare, or safety and if one or more of the following conditions are met:

(a) Compliance with this Plan cannot be technically accomplished during the duration of the water supply shortage or other condition for which the Plan is in effect.

(b) Alternative methods can be implemented which will achieve the same level of reduction in water use.

Persons requesting an exemption from the provisions of this Plan shall file a petition for variance with the _________________ (designated official) within 5 days after pro rata allocation has been invoked. All petitions for variances shall be reviewed by the __________ (governing body), and shall include the following:

(a) Name and address of the petitioner(s).

(b) Detailed statement with supporting data and information as to how the pro rata allocation of water under the policies and procedures established in the Plan adversely affects the petitioner or what damage or harm will occur to the petitioner or others if petitioner complies with this Ordinance.

(c) Description of the relief requested.

(d) Period of time for which the variance is sought.

(e) Alternative measures the petitioner is taking or proposes to take to meet the intent of this Plan and the compliance date.

(f) Other pertinent information.

Variances granted by the ___________________ (governing body) shall be subject to the following conditions, unless waived or modified by the ____________ (governing body) or its designee:

(a) Variances granted shall include a timetable for compliance.

(b) Variances granted shall expire when the Plan is no longer in effect, unless the petitioner has failed to meet specified requirements.

No variance shall be retroactive or otherwise justify any violation of this Plan occurring prior to the issuance of the variance.

Section XII: Severability

It is hereby declared to be the intention of the ________________ (governing body of your water supplier) that the sections, paragraphs, sentences, clauses, and phrases of this Plan are severable and, if any phrase, clause, sentence, paragraph, or section of this Plan shall be declared unconstitutional by the valid judgment or decree of any court of competent jurisdiction, such unconstitutionality shall not affect any of the remaining phrases, clauses, sentences, paragraphs, and sections of this Plan, since the same would not have been enacted by the ____________________ (governing body of your water supplier) without the incorporation into this Plan of any such unconstitutional phrase, clause, sentence, paragraph, or section.

DROUGHT CONTINGENCY PLAN

for

(name of irrigation district)
(date)

Section I: Declaration of Policy, Purpose, and Intent

The Board of Directors of the ___________________ (name of irrigation district) deems it to be in the interest of the District to adopt Rules and Regulations governing the equitable and efficient allocation of limited water supplies during times of shortage. These Rules and Regulations constitute the District's drought contingency plan required under Section 11.1272, Texas Water Code, *Vernon's Texas Codes Annotated*, and associated administrative rules of the Texas Commission on Environmental Quality (Title 30, Texas Administrative Code, Chapter 288).

Section II: User Involvement

Opportunity for users of water from the _________________ (name of irrigation district) was provided by means of ________________ (describe methods used to inform water users about the preparation of the plan and opportunities for input; for example, scheduling and providing notice of a public meeting to accept user input on the plan).

Section III: User Education

The _____________ (name of irrigation district) will periodically provide water users with information about the Plan, including information about the conditions under which water allocation is to be initiated or terminated and the district's policies and procedures for water allocation. This information will be provided by means of ______________ (e.g. describe methods to be used to provide water users with information about the Plan; for example, by providing copies of the Plan and by posting water allocation rules and regulations on the district's public bulletin board).

Section IV: Authorization

The ______________ (e.g.,general manager) is hereby authorized and directed to implement the applicable provision of the Plan upon determination by the Board that such implementation is necessary to ensure the equitable and efficient allocation of limited water supplies during times of shortage.

Section V: Application

The provisions fo the Plan shall apply to all persons utilizing water provided by the _______________ (name of irrigation district). The term "person" as used in the Plan includes individuals, corporations, partnerships, associations, and all other legal entities.

Section VI: Initiation of Water Allocation

The __________ (designated official) shall monitor water supply conditions on a __________ (e.g. weekly, monthly) basis and shall make recommendations to the Board regarding irrigation of water allocation. Upon approval of the Board, water allocation will become effective when _________________ (describe the criteria and the basis for the criteria):

Below are examples of the types of triggering criteria that might be used; singly or in combination, in an irrigation district's drought contingency plan:

Example 1: Water in storage in the ___________ (name of reservoir) is equal to or less than _____________ (acre-feet and/or percentage of storage capacity).

Example 2: Combined storage in the _________________ (name or reservoirs) reservoir system is equal to or less than _____________ (acre-feet and/or percentage of storage capacity).

Example 3: Flows as measured by the U.S. Geological Survey gage on the ______________ (name of reservoir) near ______________, Texas reaches ____ cubic feet per second (cfs).

Example 4: The storage balance in the district's irrigation water rights account reaches ______ acre-feet.

Example 5: The storage balance in the district's irrigation water rights account reaches an amount equivalent to _______ (number) irrigations for each flat rate acre in which all flat rate assessments are paid and current.

Example 6: The ____________ (name of entity supplying water to the irrigation district) notifies the district that water deliveries will be limited to ____________ acre-feet per year (i.e. a level below that required for unrestricted irrigation).

Section VII: Termination of Water Allocation

The district's water allocation policies will remain in effect until the conditions defined in Section IV of the Plan no longer exist and the Board deems that the need to allocate water no longer exists.

Section VIII: Notice

Notice of the initiation of water allocation will be given by notice posted on the District's public bulletin board and by mail to each ________ (e.g. landowner, holders of active irrigation accounts, etc.).

Section IX: Water Allocation

(a) In identifying **specific, quantified targets** for water allocation to be achieved during periods of water shortages and drought, each irrigation user shall be allocated _____ irrigations or ________ acre-feet of water each flat rate acre on which all taxes, fees, and charges have been paid. The water allotment in each irrigation account will be expressed in acre-feet of water.

Include explanation of water allocation procedure. For example, in the Lower Rio Grande Valley, an "irrigation" is typically considered to be equivalent to eight (8) inches of water per irrigation acre; consisting of six (6) inches of water per acre applied plus two (2) inches of water lost in transporting the water from the river to the land. Thus, three irrigations would be equal to 24 inches of water per acre or an allocation of 2.0 acre-feet of water measured at the diversion from the river.

(b) As additional water supplies become available to the District in an amount reasonably sufficient for allocation to the District's irrigation users, the additional water made available to the District will be equally distributed, on a pro rata basis, to those irrigation users having ________________.

Example 1: An account balance of less than ______ irrigations for each flat rate acre (i.e. ____ acre-feet_.

Example 2: An account balance of less than _____ acre-feet of water for each flat rate acre.

Example 3: An account balance of less than _____ acre-feet of water.

(c) The amount of water charged against a user's water allocation will be ____ (e.g. eight inches) per irrigation, or one allocation unit, unless water deliveries to the land are metered. Metered water deliveries will be charges based on actual measured use. In order to maintain parity in charging use against a water allocation between non-metered and metered deliveries, a loss factor of ____ percent of the water delivered in a metered situation will be added to the measured use and will be charged against the users water allocation. Any metered use, with the loss factor applied, that is less than eight (8) inches per acre shall be credited back to the allocation unit and will be available to the user. It shall be a violation of the Rules and Regulations for a water user to use water in excess of the amount of water contained in the users irrigation account.

(d) Acreage in an irrigation account that has not been irrigated for any reason within the last two (2) consecutive years will be considered inactive and will not be allocated water. Any landowner whose land has not been irrigated within the last two (2) consecutive years, may, upon application to the District expressing intent to irrigate the land, receive future allocations. However, irrigation water allocated shall be applied only upon the acreage to which it was allocated and such water allotment cannot be transferred until there have been two consecutive years of use.

Section X: Transfers of Allotments

(a) A water allocation in an active irrigation account may be transferred within the boundaries of the District from one irrigation account to another. The transfer of water can only be made by the landowner's agent who is authorized in writing to act on behalf of the landowner in the transfer of all or part of the water allocation from the described land of the landowner covered by the irrigation account.

(b) A water allocation may not be transferred to land owned by a landowner outside the District boundaries.

or

A water allocation may be transferred to land outside the District's boundaries by paying the current water charge as if the water was actually delivered by the District to the land covered by an irrigation account. The amount of water allowed to be transferred shall be stated in terms of acre-feet and deducted from the landowner's current allocation balance in the irrigation account. Transfers of water outside the District shall not affect the allocation of water under Section VII of these Rules and Regulations.

(c) Water from outside the District may not be transferred by a landowner for use within the District.

or

Water from outside the District may be transferred by a landowner for use within the District. The District will divert and deliver the water on the same basis as District water is delivered, except that a ___ percent conveyance loss will be charged against the amount of water transferred for use in the District as the water is delivered.

Section XI: Penalties

Any person who willfully opens, closes, changes or interferes with any headgate or uses water in violation of these Rules and Regulations, shall be considered in violation of Section 11.0083, Texas Water Code, *Vernon's Texas Codes Annotated*, which provides for punishment by fine of not less than $10.00 nor more than $200.00 or by confinement in the county jail for not more than thirty (30) days, or both, for each violation, and these penalties provided by the laws of the State and may by enforced by complaints filed in the appropriate court jurisdiction in ______ County, all in accordance with Section 11.083; and in addition, the District may pursue a civil remedy in the way of damages and/or injunction against the violation of any of the foregoing Rules and Regulations.

Section XII: Severability

It is hereby declared to be the intention of the Board of Directors of the _____________ (name of irrigation district) that the sections, paragraphs, sentences, clauses, and phrases of this Plan shall be declared unconstitutional by the valid judgment or decree of any court of competent jurisdiction, such unconstitutionality shall not affect any of the remaining phrases, clauses, sentences, paragraphs, and sections of this Plan, since the same would not have been enacted by the Board without the incorporation into this Plan of any such unconstitutional phrase, clause, sentence, paragraph, or section.

Section XIII: Authority

The foregoing rules and regulations are adopted pursuant to and in accordance with Sections 11.039, 11.083, 11.1272; Section 49.004; and Section 58.127-130 of the Texas Water Code, *Vernon's Texas Codes Annotated.*

Section XIV: Effective Date of Plan

The effective date of this Rule shall be five (5) days following the date of Publication hereof and ignorance of the Rules and Regulations is not a defense for a prosecution for enforcement of the violation of the Rules and Regulations.

EXAMPLE RESOLUTION FOR ADOPTION OF A DROUGHT CONTINGENCY PLAN

RESOLUTION NO. __________

A RESOLUTION OF THE BOARD OF DIRECTORS OF THE __________________ (name of water supplier) ADOPTING A DROUGHT CONTINGENCY PLAN.

WHEREAS, the Board recognizes that the amount of water available to the ____________ (name of water supplier) and its water utility customers is limited and subject to depletion during periods of extended drought;

WHEREAS, the Board recognizes that natural limitations due to drought conditions and other acts of God cannot guarantee an uninterrupted water supply for all purposes;

WHEREAS, Section 11.1272 of the Texas Water Code and applicable rules of the Texas Commission on Environmental Quality require all public water supply systems in Texas to prepare a drought contingency plan; and

WHEREAS, as authorized under law, and in the best interests of the customers of the _________________(name of water supply system), the Board deems it expedient and necessary to establish certain rules and policies for the orderly and efficient management of limited water supplies during drought and other water supply emergencies;

NOW THEREFORE, BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE _________________ (name of water supplier):

SECTION 1. That the Drought Contingency Plan attached hereto as Exhibit AA@ and made part hereof for all purposes be, and the same is hereby, adopted as the official policy of the ________________ (name of water supplier).

SECTION 2. That the _______________ (e.g., general manager) is hereby directed to implement, administer, and enforce the Drought Contingency Plan.

SECTION 3. That this resolution shall take effect immediately upon its passage.

DULY PASSED BY THE BOARD OF DIRECTORS OF THE _______________, ON THIS __ day of ______________, 20__.

____
President, Board of Directors

ATTESTED TO:

____
Secretary, Board of Directors

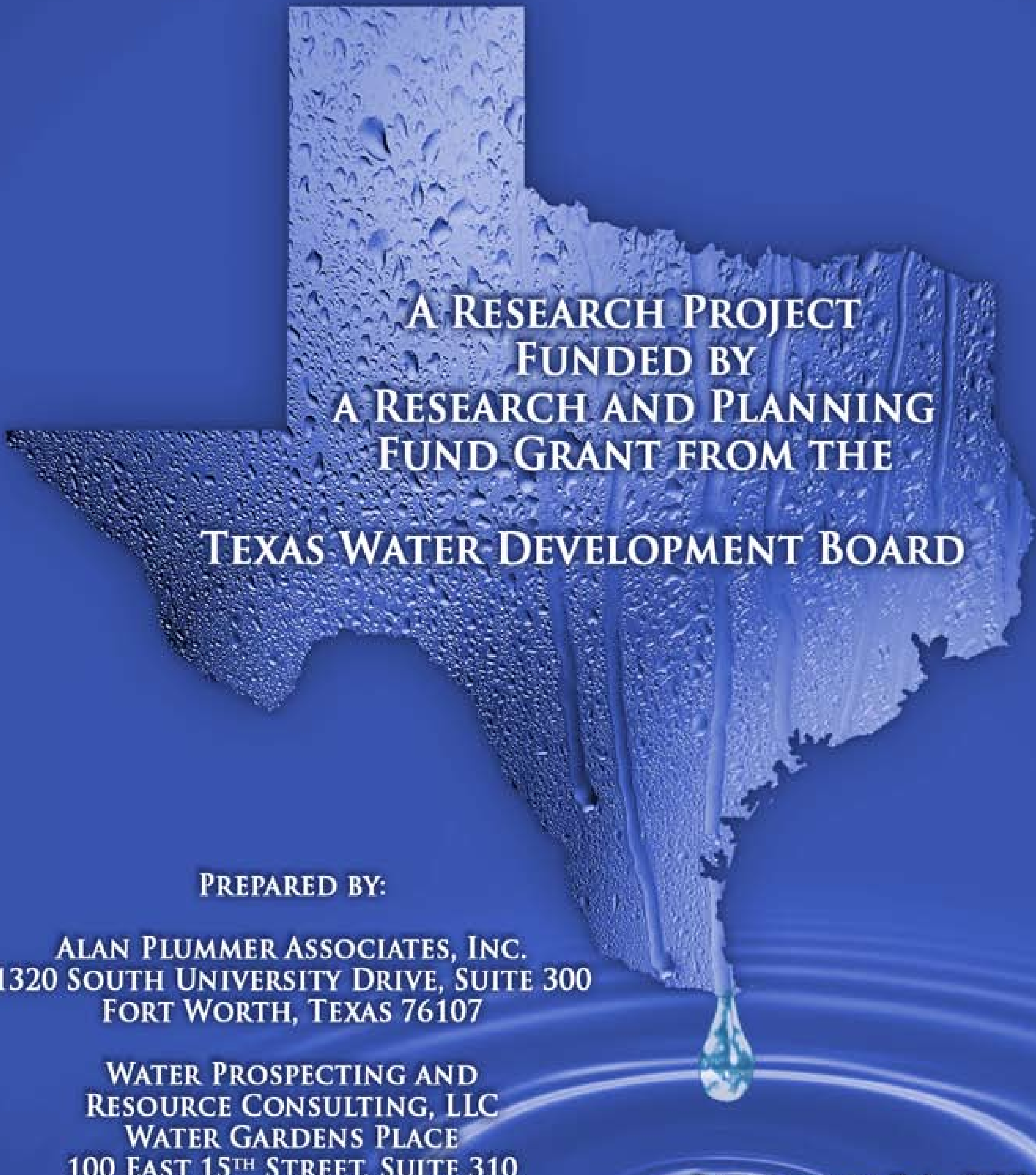
ATTACHMENT 6-3

REGIONAL WATER PLANNING GROUP B

EXECUTIVE SUMMARY AND COMPARATIVE WATER LOSS ANALYSIS BY REGIONAL WATER PLANNING AREA

FINAL REPORT

AN ANALYSIS OF WATER LOSS AS REPORTED BY PUBLIC WATER SUPPLIERS IN TEXAS



A RESEARCH PROJECT
FUNDED BY
A RESEARCH AND PLANNING
FUND GRANT FROM THE

TEXAS WATER DEVELOPMENT BOARD

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JANUARY 24, 2007

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1 EXECUTIVE SUMMARY – ANALYSIS OF WATER LOSS

The first broad analysis of water loss for retail public utilities in Texas reveals that:

- Approximately half of retail public utilities in Texas reported their water loss data.
- Reporting utilities serve as much as 84 percent of the state's population.[1]
- A substantial amount of water (the balancing adjustment) was not attributed to any water use category, causing significant uncertainty in estimates of water loss and non-revenue water.
- Reporting utilities experienced total water loss[2] of 212,221 to 464,219 acre-feet per year,[3] or 5.6 to 12.3 percent[3] of all water entering the reporting systems. Based on the 2004 statewide average municipal water use of 150 gallons per capita per day,[A,4] equivalent water volumes could supply between 1.3 million and 2.7 million Texans.[5]
- Reporting utilities experienced non-revenue water[6] of 311,333 to 563,331 acre-feet per year,[3] or 8.3 to 15.0 percent[3] of all water entering the reporting systems.
- When extrapolated to all retail public utilities in Texas, the statewide value of total water loss is estimated to be between $152 million and $513 million per year.
- Reporting utilities may have underestimated their real water loss.

This research provides information necessary for the Texas Water Development Board (TWDB), Regional Water Planning Groups (RWPGs), and retail public utilities to direct planning and funding resources, to recover lost revenue through reduction of non-revenue water, and to achieve water savings through reduction of real loss.

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1 This percentage is uncertain because some utilities reported both retail and wholesale customer populations.
2 Total water loss includes real loss (water that was physically lost from the system, such as main breaks and leaks, customer service line breaks and leaks, and storage overflows) and apparent loss (water that was not accurately measured and billed to a customer, such as unauthorized consumption, customer meter under-registering, and billing adjustment and waivers).
3 The smaller number is the total reported by the utilities. The larger number is based on the assumption that the entire balancing adjustment is water loss.
4 References are denoted with letters and are presented in Chapter 17. Footnotes are denoted with numbers and are presented at the bottom of the same page.
5 However, it is not possible to recover all water loss.
6 Non-revenue water includes real loss, apparent loss, and unbilled authorized consumption. Unbilled authorized consumption includes water used for fire fighting, sewer flushing, etc.

1.A Introduction

Water loss minimization can be an important water conservation strategy for retail water suppliers. Historically, retail public utilities have lacked detailed knowledge about their water loss performance. This is due partially to a lack of careful water auditing and partially to inconsistent water loss reporting using non-uniform statistics, including the use of "unaccounted-for water" percentages to compare performance. As a result, utilities may not know whether their water losses are due to leaks, accounting practices, theft, metering problems, or other factors, and may have difficulty developing water loss minimization strategies.

To address the lack of information on water loss, the 78th Texas Legislature passed House Bill 3338, which required retail public utilities that provide potable water to "perform and file with the [Texas Water Development Board] a water audit computing the utility's most recent annual system water loss"[B] every five years. Under this authority, the Texas Water Development Board (TWDB) instituted new water audit reporting requirements[C] that require retail public utilities to carefully audit their system water use at least once every five years; to estimate system water use in standard, well defined categories; and to report their first set of water loss data to the TWDB by March 31, 2006.

The new water audit reporting requirements follow a methodology that is recommended by the International Water Association (IWA) and the American Water Works Association (AWWA) Water Loss Control Committee. This methodology relies on strictly defined water use categories (Table 1-1) and water loss performance indicators and is becoming the international water loss accounting standard. The IWA Water Loss Task Force (which included AWWA participation) developed this methodology from 1997 through 2000.[D] The first reference to the methodology's performance indicators was published in 2000.[E (cited in D)]

The U.S. Bureau of Reclamation (BOR) has designated a number of "hot spots" in the Western U.S. where existing water supplies are projected to be inadequate to meet the demands of people, farms, and the environment by the year 2025, including six hot spots in Texas.[F] As part of the Water 2025 Program, the BOR offered Challenge Grants to fund projects related to "water conservation, efficiency and markets and collaboration. Recognizing this program as an opportunity to partner with the BOR, to leverage its existing budget, and to enhance conservation technical assistance, the TWDB applied for and received a Challenge Grant for two purposes: 1) to purchase 10 acoustical leak-detection units and make them available to public water suppliers, and 2) to perform an analysis of water loss in Texas, using water loss data provided by public water suppliers. The TWDB solicited proposals for the analysis of water loss and subsequently awarded a Research and Planning Fund Grant to the research team of Alan Plummer Associates, Inc., and Water Prospecting and Resource Consulting, LLC.

This executive summary describes the results of a research project to examine the reported water loss data for consistency, errors, omissions, and other quality control issues; to calculate water loss performance statistics; to compare water loss performance by utility location, type, and size; and to make recommendations for improving the water audit reporting process. The details of the data quality control are discussed in later chapters. A statewide summary of water loss performance, comparative analysis of water loss performance, and recommendations are presented below.

1.B Statewide Summary of Water Loss Performance

For reporting utilities, statewide totals for each water use category are shown in Table 1-1 (acre-feet), Table 1-2 (gallons), and Table 1-3 (percent of corrected input volume). The total reported corrected input volume[7] is 3,761,965 acre-feet over approximately one year. This figure includes retail water sales and wholesale water sales[8] for the reporting utilities.

The balancing adjustment in Table 1-1 through Table 1-3 is the water volume remaining after authorized consumption and total water loss are subtracted from the amount of water that entered the utility system (the corrected input volume). If a utility perfectly accounts for its water use, the balancing adjustment equals zero.

[7] Corrected input volume is the amount of water that was actually delivered to a utility, including water that was not measured by the master meter(s).

[8] A retail water sale is the sale of water to the end user. A wholesale water sale is the sale of water to a utility that resells the water.

Table 1-1: Statewide Totals of Reported Water Loss* (acre-feet)

<table>
<tr><td rowspan="11">Corrected input volume
(3,758,484)</td><td rowspan="4">Authorized consumption
(3,294,265)</td><td rowspan="2">Billed authorized consumption
(3,195,153)</td><td>Billed metered consumption
(3,190,972)</td><td rowspan="2">Revenue water
(3,195,153)</td></tr>
<tr><td>Billed unmetered consumption
(4,181)</td></tr>
<tr><td rowspan="2">Unbilled authorized consumption
(99,112)</td><td>Unbilled metered consumption
(52,698)</td><td rowspan="8">Non-revenue water
(311,333)</td></tr>
<tr><td>Unbilled unmetered consumption
(46,414)</td></tr>
<tr><td rowspan="6">Water losses
(212,221)</td><td rowspan="3">Apparent losses
(109,310)</td><td>Unauthorized consumption
(10,770)</td></tr>
<tr><td>Customer meter under-registering
(87,218)</td></tr>
<tr><td>Billing adjustment and waivers
(11,322)</td></tr>
<tr><td rowspan="3">Real losses
(102,910)</td><td>Main breaks and leaks
(83,529)</td></tr>
<tr><td>Storage overflows
(3,341)</td></tr>
<tr><td>Customer service line breaks and leaks
(16,040)</td></tr>
<tr><td colspan="4">Balancing Adjustment**
(251,998)</td></tr>
</table>

* Over approximately one year. Most utilities reported data for calendar or fiscal year 2005.

** Balancing adjustment is the corrected input volume minus authorized consumption minus total water loss. If all water is fully attributed to the various potential uses, balancing adjustment is zero. Balancing adjustment may consist of underestimated real loss, apparent loss, or authorized consumption. Without further refinement of a utility's water audit, there is no accurate *ad hoc* method for determining the actual water use for water that has been allocated to balancing adjustment.

Table 1-2: Statewide Totals of Reported Water Loss* (gallons)

<table>
<tr><td rowspan="11">Corrected input volume
(1,224,705,675,107)</td><td rowspan="4">Authorized consumption
(1,073,439,695,489)</td><td rowspan="2">Billed authorized consumption
(1,041,143,853,511)</td><td>Billed metered consumption
(1,039,781,485,415)</td><td rowspan="2">Revenue water
(1,041,143,853,511)</td></tr>
<tr><td>Billed unmetered consumption
(1,362,368,096)</td></tr>
<tr><td rowspan="2">Unbilled authorized consumption
(32,295,841,978)</td><td>Unbilled metered consumption
(17,171,730,325)</td><td rowspan="8">Non-revenue water
(101,448,133,344)</td></tr>
<tr><td>Unbilled unmetered consumption
(15,124,111,653)</td></tr>
<tr><td rowspan="6">Water losses
(69,152,291,366)</td><td rowspan="3">Apparent losses
(35,618,824,222)</td><td>Unauthorized consumption
(3,509,318,446)</td></tr>
<tr><td>Customer meter under-registering
(28,420,204,130)</td></tr>
<tr><td>Billing adjustment and waivers
(3,689,301,646)</td></tr>
<tr><td rowspan="3">Real losses
(33,533,467,144)</td><td>Main breaks and leaks
(27,218,129,878)</td></tr>
<tr><td>Storage overflows
(1,088,723,441)</td></tr>
<tr><td>Customer service line breaks and leaks
(5,226,613,826)</td></tr>
<tr><td colspan="4">Balancing Adjustment**
(82,113,688,252)</td></tr>
</table>

* Over approximately one year. Most utilities reported data for calendar or fiscal year 2005.

** Balancing adjustment is the corrected input volume minus authorized consumption minus total water loss. If all water is fully attributed to the various potential uses, balancing adjustment is zero. Balancing adjustment may consist of underestimated real loss, apparent loss, or authorized consumption. Without further refinement of a utility's water audit, there is no accurate *ad hoc* method for determining the actual water use for water that has been allocated to balancing adjustment.

Table 1-3: Statewide Percentages of Reported Water Loss*

<table>
<tr><td rowspan="11">Corrected input volume
(100.0)</td><td rowspan="4">Authorized consumption
(87.6)</td><td rowspan="2">Billed authorized consumption
(85.0)</td><td>Billed metered consumption
(84.9)</td><td rowspan="2">Revenue water
(85.0)</td></tr>
<tr><td>Billed unmetered consumption
(0.1)</td></tr>
<tr><td rowspan="2">Unbilled authorized consumption
(2.6)</td><td>Unbilled metered consumption
(1.4)</td><td rowspan="8">Non-revenue water
(8.3)</td></tr>
<tr><td>Unbilled unmetered consumption
(1.2)</td></tr>
<tr><td rowspan="6">Water losses
(5.6)</td><td rowspan="3">Apparent losses
(2.9)</td><td>Unauthorized consumption
(0.3)</td></tr>
<tr><td>Customer meter under-registering
(2.3)</td></tr>
<tr><td>Billing adjustment and waivers
(0.3)</td></tr>
<tr><td rowspan="3">Real losses
(2.7)</td><td>Main breaks and leaks
(2.2)</td></tr>
<tr><td>Storage overflows
(0.1)</td></tr>
<tr><td>Customer service line breaks and leaks
(0.4)</td></tr>
<tr><td colspan="4">Balancing Adjustment**
(6.7)</td></tr>
</table>

* Over approximately one year. Most utilities reported data for calendar or fiscal year 2005.

** Balancing adjustment is the corrected input volume minus authorized consumption minus total water loss. If all water is fully attributed to the various potential uses, balancing adjustment is zero. Balancing adjustment may consist of underestimated real loss, apparent loss, or authorized consumption. Without further refinement of a utility's water audit, there is no accurate *ad hoc* method for determining the actual water use for water that has been allocated to balancing adjustment.

Some or all of the balancing adjustment is due to underestimation of real and apparent water losses. Without further refinement of a utility's water audit, there is no accurate *ad hoc* method for determining the actual water use for water that has been allocated to balancing adjustment. Therefore, for a given water loss performance indicator, a range of potential values are presented. One end of the range is calculated directly from the reported water loss data, and the other end of the range is based on the assumption that all of the balancing adjustment is unreported water loss (either real or apparent, depending on the performance indicator). The balancing adjustment may be a positive quantity or a negative quantity.

Assuming the real loss is valued at the marginal production water cost and that apparent loss and the balancing adjustment are valued at the retail water cost, the estimated value of total water loss in Texas is between $152 million and $513 million per year.[9] Adding the value of unbilled authorized consumption to these totals gives an estimated value of non-revenue water in Texas between $253 million and $635 million. To increase the reliability and narrow the range of these estimates, the production and retail water costs must be more uniformly reported, and utilities must refine their water accounting, thereby reducing the balancing adjustment.

Statewide median and average water loss performance indicators are shown in Table 1-4. Generally speaking, the balancing adjustment is too large in relation to other quantities to draw reliable conclusions about water loss trends. From all reported data, balancing adjustment was 6.7 percent of total corrected input volume, while real loss was 2.7 percent, and apparent loss was 2.9 percent. On average, therefore, the balancing adjustment is larger than sum of the real and apparent losses. Given similar statistics, an individual utility would not be able to determine whether its best strategy is to reduce real loss or to reduce apparent loss.

The screening-level infrastructure leakage index (SLILI) is the real loss divided by the theoretical unavoidable annual real loss. In theory, the SLILI should not be less than one, because the real loss should not be less than the unavoidable real loss. However, the statewide median SLILI is 0.22 when calculated from reported data. In addition, the statewide median real loss is 3.6 gallons per connection per day, which is only about 23 percent of the lowest identified

[9] This estimate is not fully reliable, because up to 10 percent of the reported production and retail water costs were modified as discussed in Chapters 3.B.13 and 3.B.14. Not all non-revenue water can be recovered.

Table 1-4: Statewide Summary of Reported Water Loss Data

Statistic or Performance Indicator	Units	Median from Reported Data	Median With Balancing Adjustment Assumption	Average from Reported Data	Average With Balancing Adjustment Assumption
Absolute Value of Balancing Adjustment/Corrected Input Volume[10]	%	2.6	2.6	7.1	7.1
Real Loss per Mile of Main Per Day	gal/mi/day	77	233	204	417
Real Loss per Service Connection per Day	gal/conn/day	3.6	18.8	14	51
Apparent Loss per Service Connection per Day	gal/conn/day	6.4	17.5	15	51
Non-Revenue Water/Corrected Input Volume	%	7.3	13.4	8.3	15.0
Value of Real Loss per Mile of Main Per Day	$/mi/day	0.12	0.31	0.24	0.49
Value of Real Loss per Service Connection per Day	$/conn/day	0.004	0.018	0.010	0.040
Value of Apparent Loss per Service Connection per Day	$/conn/day	0.018	0.046	0.042	0.140
Screening-Level Infrastructure Leakage Index (SLILI)[11]	--	0.22	2.04	1.08	4.10

[10] The average of the absolute value balancing adjustment as a percentage of corrected input volume does not match the balancing adjustment percentage shown in Table 9-3, because the balancing adjustment is a negative quantity for some utilities.

[11] Calculation of the Screening-Level Infrastructure Leakage Index was performed only for utilities with 5,000 or more connections and 32 or more connections per mile of main. See discussion in Chapter 5.C.

real loss for a North American system (16 gal/conn/day for Halifax Central, shown in Table 7-1).

Even assuming that the balancing adjustment is unreported real loss, the statewide median SLILI is only 2.04, and the statewide median real loss is 18.8 gal/conn/day. Compared to the American Water Works Association (AWWA) guidelines for ILI goals (Table 7-3) and real loss performance by North American utilities (Table 7-1), these statistics seem to indicate that at least half of reporting utilities have excellent real loss control. However, most utilities in Texas practice real loss control in a reactive way (rather than a proactive way), so it is surprising that half of the reporting utilities have such excellent real loss performance, particularly in comparison to other North American utilities.

Because the actual statewide median SLILI value is so low (somewhere between 0.22 and 2.04), it appears that most reporting utilities have underestimated actual real loss. Furthermore, from comparison to AWWA guidelines and real loss performance by other North American utilities, it appears likely that the actual real loss is underestimated even if the balancing adjustment is treated as real loss. Real loss estimation problems notwithstanding, at least 8 to 30 percent of Texas utilities with more than 5,000 connections and 32 or more connections per mile of main have an SLILI greater than 3.0 (Appendix C).

1.C Comparative Analysis of Water Loss Performance

Water loss performance was also compared on the basis of utility location, type, size, water source, and connection density. The primary findings of the comparative analysis are similar to the findings in the statewide summary: the balancing adjustment is too large to allow identification of trends in the water loss data, and real loss appears to be underestimated. Other findings from the comparative analysis are discussed further in the conclusions and recommendations section (Chapter 1.D).

1.D Recommendations

This report, the first broad analysis of water loss and water loss accounting for retail public utilities in Texas, provides information necessary for the TWDB, RWPGs, and retail public utilities to direct planning and funding resources, to recover lost revenue through reduction of non-revenue water, and to achieve water savings through reduction of real loss. However, the size of the balancing adjustment results in significant uncertainty in the water loss performance indicators. Recommendations for improving water loss performance and water loss accounting are presented below in the following categories: water loss performance, regional water planning, and TWDB actions.

1.D.1 Water Loss Performance

Recommendations regarding balancing adjustment, real loss, connection density, non-revenue water, and the value of total water loss are discussed below.

Balancing Adjustment

Recommendation #1: Utilities should refine their water audits until the balancing adjustment is small in comparison to the other quantities of interest (*e.g.*, real and apparent water loss) so that reliable conclusions about water loss trends can be drawn. It may be tempting to change the volumes in some water use categories for the sole purpose of eliminating the balancing adjustment. This is not a legitimate way to reduce balancing adjustment: it only disguises the real issues, making it harder to identify what strategies a utility should pursue in the future. To legitimately reduce balancing adjustment, a utility should refine its estimates for each water use category by implementing more accurate measurement and/or estimation procedures.

Recommendation #2: Although utilities are only required to report their water audits every five years, utilities should implement annual or biennial programs to develop the data necessary to gradually reduce the uncertainty in their water audits and should review their water audits annually or biennially. Programs should target the water audit categories with the most uncertain water volume estimates.

Real Loss

Recommendation #3: Because it appears that utilities have underestimated real loss, utilities should refine their water audits to better estimate their actual real loss. This may involve confirmation of existing information (*e.g.*, calibration of production and consumption meters), additional analysis of existing information, and collection of new information (*e.g.*, flow monitoring in District Metered Areas).

Recommendation #4: Utilities should determine their economic level of leakage (ELL) and should use the ELL as a goal for real loss. Prior to determining an ELL, utilities should strive for a maximum ILI of 3.0 (Table 7-3). Utilities with an SLILI greater than 3.0 and other utilities with significant real loss in comparison to other North American utilities (Table 7-1) should consider implementing real loss control measures.

Water Loss Performance and Connection Density

Recommendation #5: Average real loss per mile of main per day increases with increasing connection density,[12] and average non-revenue water percentage decreases with increasing connection density (Figure I-2 in Appendix I). Reasons for these trends should be identified. Future analysis of water loss performance should consider connection density as an independent variable, along with utility location, type, and size.

Non-Revenue Water

Recommendation #6: Utilities should determine their economic target level for non-revenue water and strive to reduce their non-revenue water to the economic target level. In particular, utilities in Regions I and J should consider steps to recover lost revenue from unbilled authorized consumption, and utilities in Harris, Hidalgo, Nueces, Tarrant, and Travis Counties should consider steps to reduce non-revenue water.

Statewide Value of Total Water Loss

Recommendation #7: The estimated total value of total water loss in Texas is between $152 million and $513 million per year. To increase the reliability and narrow the range of this estimate, the production and retail water costs should be reported in consistent units, and utilities must refine their water accounting, thereby reducing the balancing adjustment.

[12] The number of service connections per mile of main.

1.D.2 Regional Water Planning

Recommendation #8: RWPGs should use the research results to estimate potential water savings from system water audits and water loss prevention strategies and should update the regional water plans as appropriate.

Recommendation #9: The TWDB should work to align the regional water planning cycle and the water audit reporting cycle so that up-to-date water loss data is used in developing the regional water plans.

1.D.3 TWDB Actions to Enhance Water Loss Accounting and Prevention

The TWDB should consider the following general actions to enhance water loss accounting and prevention in Texas:

Recommendation #10: To provide a more comprehensive picture of water loss in Texas, the TWDB should consider extending water auditing requirements to include wholesale utilities that provide raw or potable water. This may require additional authorization from the Legislature.

Recommendation #11: The TWDB should continue to promote water loss prevention to retail public utilities, focusing on the retail public utilities that have the greatest need for water loss reduction.

Recommendation #12: To make the water loss data more comprehensive, the TWDB should continue to seek water audit data from retail public utilities that have not reported.

Recommendation #13: The TWDB should continue to provide equipment, education, and financial assistance to help retail public utilities achieve improved water loss accounting and water loss performance.

Recommendation #14: To minimize the impact of balancing adjustment on the water loss analysis, the TWDB should consider devoting additional personnel and/or resources to assisting utilities with refinement of their water audits.

Recommendation #15: The TWDB should convey the findings, conclusions, and recommendations of this research effort to stakeholders through workshops or other means of communication.

In addition, the water loss reporting process should be revised to help assure data quality and to make the maximum use of reported water loss data. Additional recommendations regarding data quality control and the water loss reporting process are presented in Chapter 16.

10 COMPARATIVE ANALYSIS BY REGIONAL WATER PLANNING AREA

Water loss results were compared across the 16 regional water planning areas in Texas (Figure 10-1). The distribution of reporting utilities and the total corrected input volume is shown by region in Figure 10-2. As discussed in the previous chapter, wholesale water sales are included in the corrected input volume multiple times, so the total corrected input volume does not necessarily reflect total retail water use.

Regional statistics and water loss performance indicators are presented in the following sections.

10.A Regional Statistics

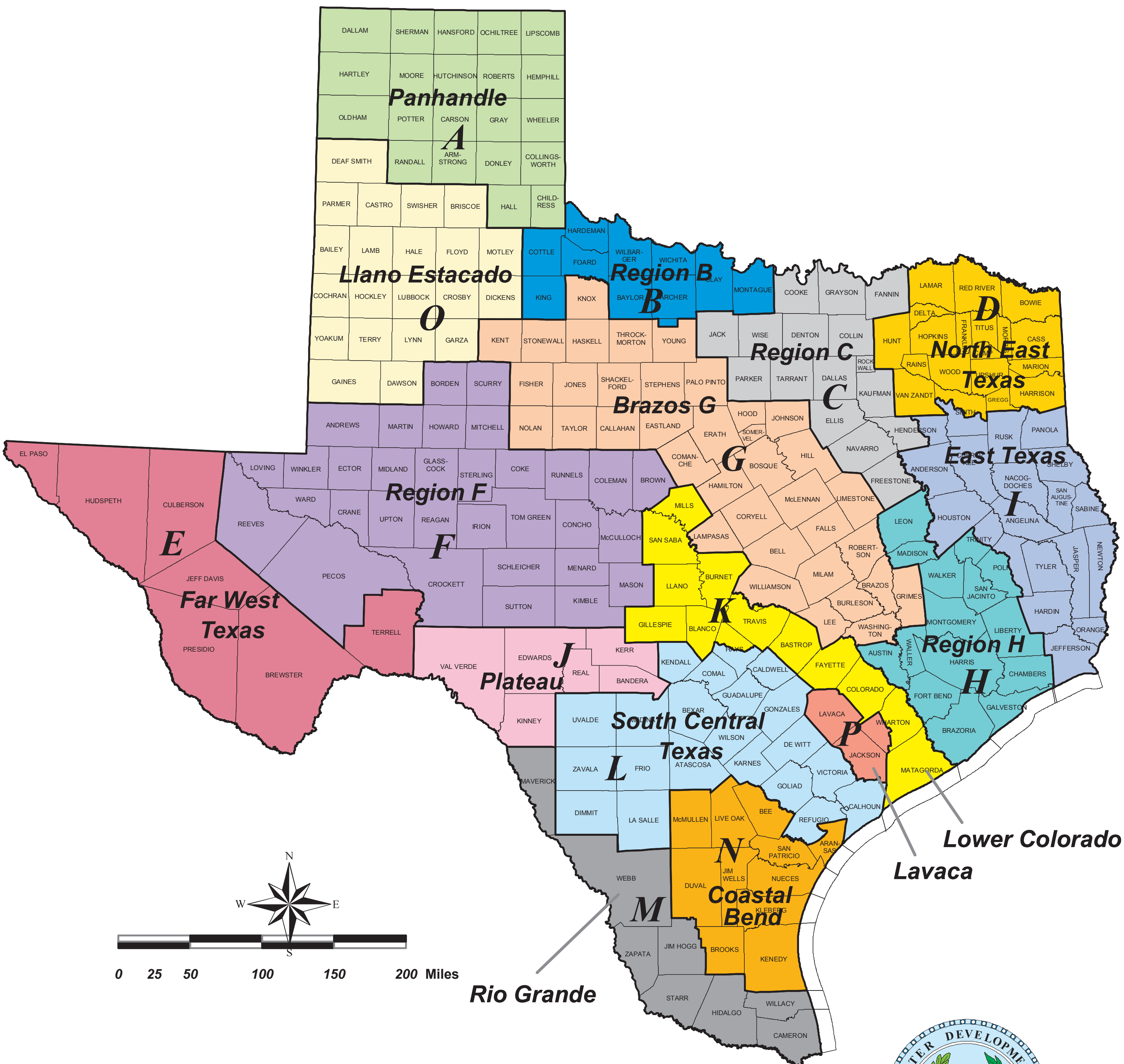
Several additional regional average quantities can be derived from the reported data (Table 10-1). The ranges of the regional averages are:

- Master meter accuracy: 95.7 – 100.3 percent
- Customer meter accuracy: 94.1 – 99.5 percent
- Production water cost: $0.34 – $2.02 per thousand gallons
- Retail water cost: $0.94 – $5.13 per thousand gallons
- Service connections per mile of main: 14.6 – 89.6
- Reporting period: 346.7 – 383.5 days

10.B Regional Water Loss Performance Indicators

The average reported non-revenue water as a percentage of corrected input volume for each region is shown in Figure 10-3. Regions I and J have the highest average non-revenue water percentage (ranging from approximately 19 percent to as much as 27 percent). These regions also had the highest reported average unbilled authorized water use, at 5.5 percent and 9.4 percent of corrected input volume, respectively, compared to the statewide reported average of 2.6 percent. Utilities in Regions I and J should consider steps to recover lost revenue from unbilled authorized consumption. This will reduce the non-revenue water percentage in these regions.

*Figure 10-1: Regional Water Planning Areas in Texas**



* Texas Water Development Board,
Available URL: http://www.twdb.state.tx.us/mapping/maps/pdf/sb1_groups_8x11.pdf,
accessed November 2006.

Figure 10-2: Distribution of Reporting Utilities by Regional Water Planning Area

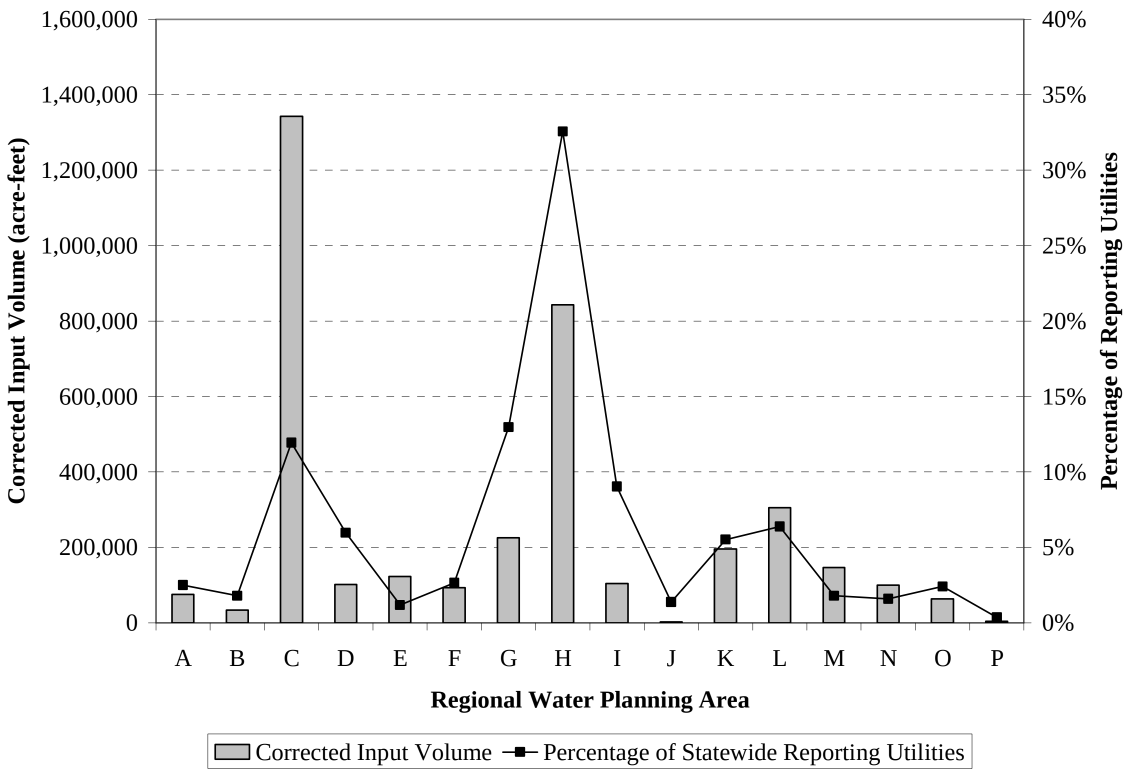
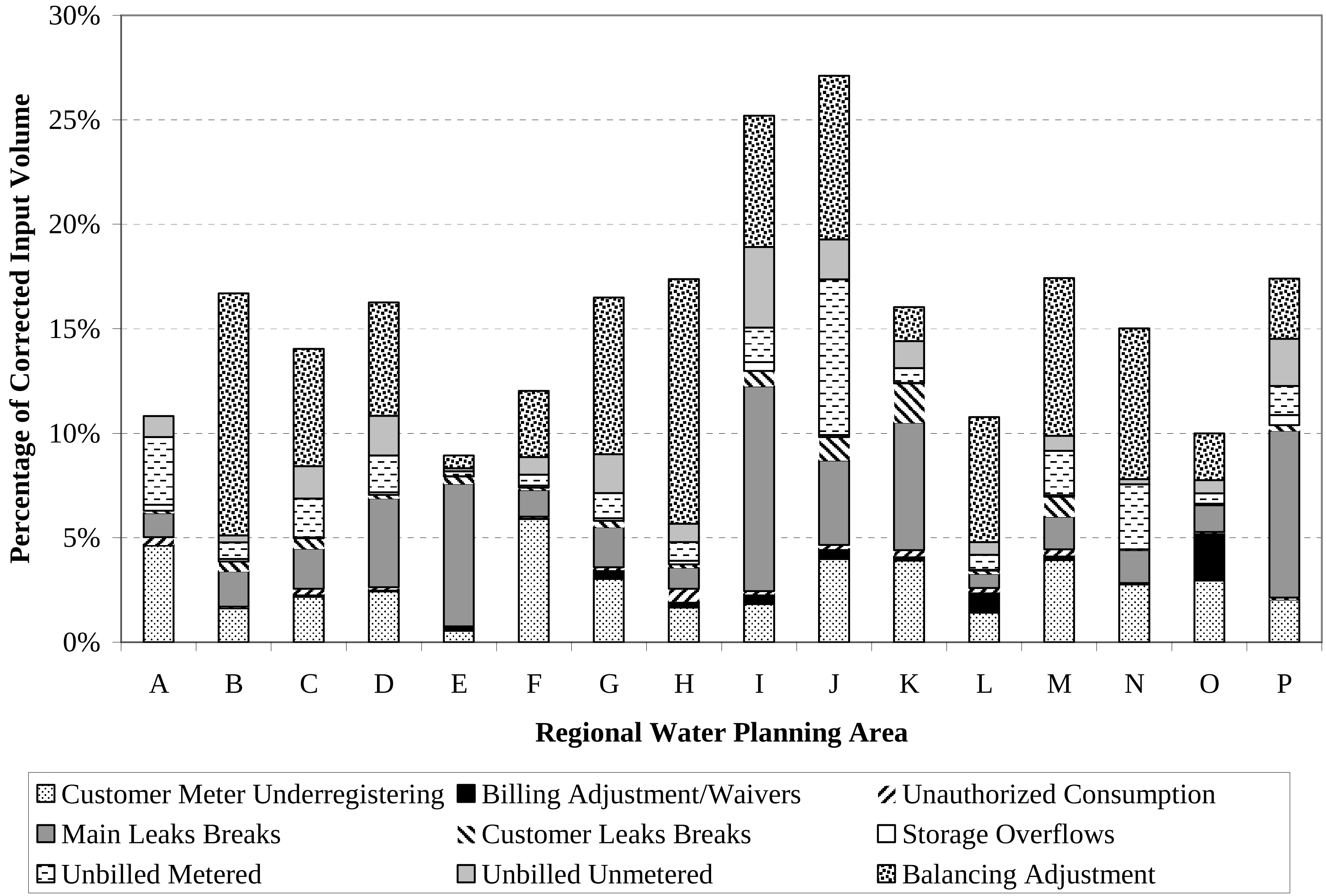


Table 10-1: Regional Average Quantities

Region	Master Meter Accuracy	Customer Meter Accuracy	Production Water Cost ($/1,000 gallons)	Retail Water Cost ($/1,000 gallons)	Service Connections per Mile of Main	Reporting Period
A	98.0%	95.4%	$0.70	$1.89	40.2	362.8
B	98.4%	98.4%	$1.70	$3.11	22.3	365.4
C	99.7%	97.8%	$0.90	$2.60	51.2	366.0
D	99.0%	97.6%	$1.51	$3.96	14.6	383.5
E	99.4%	99.5%	$0.61	$2.52	73.9	346.7
F	99.1%	94.1%	$2.02	$2.66	29.6	372.1
G	98.5%	97.0%	$1.42	$2.85	19.5	363.0
H	98.4%	98.3%	$0.80	$2.38	89.6	363.4
I	99.8%	98.2%	$0.34	$2.68	19.2	363.5
J	97.9%	96.0%	$0.91	$3.09	27.9	360.7
K	100.3%	96.1%	$0.57	$2.89	38.8	360.0
L	99.6%	98.6%	$1.20	$5.13	50.0	364.6
M	99.3%	96.1%	$0.72	$1.81	38.2	364.2
N	95.7%	97.2%	$1.62	$2.46	38.7	364.1
O	98.5%	97.0%	$0.86	$1.64	49.0	380.4
P	98.3%	98.0%	$0.36	$0.94	47.0	365.0
TOTAL	99.1%	97.7%	$0.84	$2.72	43.5	365.2

Figure 10-3: Average Annual Non-Revenue Water by Region



The average annual value of non-revenue water per connection is shown by region in Figure 10-4.[9] On a per-connection basis, utilities in Region E report the lowest average value of non-revenue water (approximately $14 per connection per year), and utilities in Regions D and K report the highest average value of non-revenue water (more than $50 per connection per year). Reported values include real loss, apparent loss, and unbilled authorized consumption. However, after accounting for the balancing adjustment, the average value of non-revenue water in Regions B, C, D, G, L, and N may be more than $80 per connection per year. The total balancing adjustment for Region A is negative, which causes the balancing adjustment assumption to reduce the average value of non-revenue water.

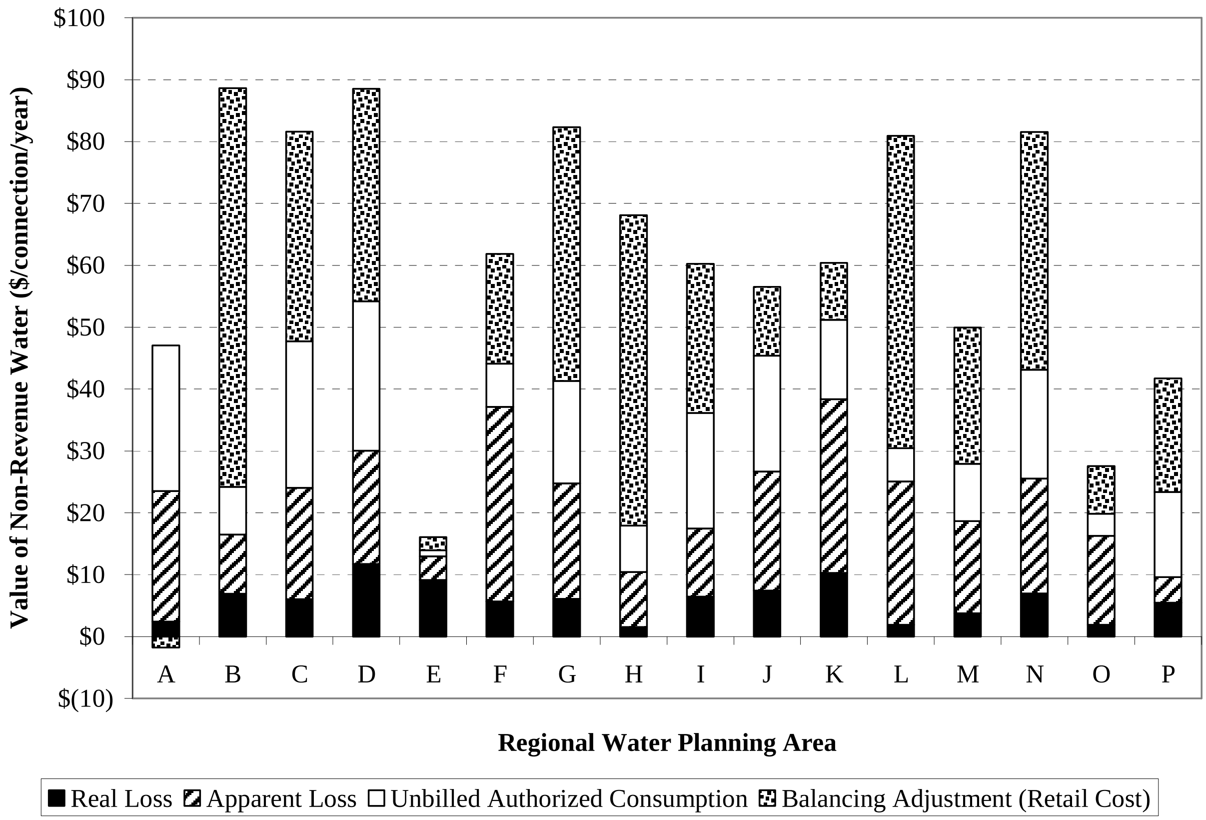
Graphs showing other average water loss performance indicators by region for all reporting water utilities (after quality control) are presented in Appendix D. These graphs present the performance indicators with and without the balancing adjustment assumption discussed in Chapter 6.A. The ranges of average real loss and average SLILI are on the low end of the ranges of real loss and ILI reported by North American utilities (Table 7-1), while the range of average apparent loss is similar to, or perhaps somewhat greater than, the range of apparent loss reported by North American utilities.

Regions B, H, and M each have an average balancing adjustment (absolute value) that is more than 10 percent of the corrected input volume (Figure D-1). With the balancing adjustment assumption, this results in a relatively wide range of upper and lower bounds for water loss performance indicators for these regions. This suggests that utilities in these regions should refine their water accounting procedures to more accurately quantify water use in each category.

Three regions (A, F, and O) have average SLILI values that range from 0.36 to 0.71 as calculated from the reported data and range from 0.71 to 1.77 with the balancing adjustment assumption (Figure D-4). As discussed in Chapter 5.C, the theoretical minimum SLILI is 1. These observations suggest that the larger utilities[25] in these regions may be underestimating real loss. It is interesting to note that these regions are contiguous and are located in West Texas and the Panhandle (Figure D-12). It is not known whether there is a common geographic or system factor that would result in low levels of real loss in these regions.

[25] Utilities having 5,000 connections or more and 32 or more connections per mile of main.

Figure 10-4: Average Annual Value of Non-Revenue Water per Connection by Region



The average SLILI values for Regions I and K suggest that the larger utilities[25] in these regions might benefit from real loss control measures.

CHAPTER 7

DESCRIPTION OF HOW THE REGIONAL WATER PLAN IS CONSISTENT WITH LONG-TERM PROTECTION OF THE STATE'S WATER RESOURCES, AGRICULTURAL RESOURCES, AND NATURAL RESOURCES

TEXAS STATE WATER PLAN

REGION B

SEPTEMBER 2010

DESCRIPTION OF HOW THE REGIONAL WATER PLAN IS CONSISTENT WITH LONG-TERM PROTECTION OF THE STATE'S WATER RESOURCES, AGRICULTURAL RESOURCES, AND NATURAL RESOURCES
TEXAS STATE WATER PLAN
REGION B

7.1 Introduction

The development of viable strategies to meet the demand for water is the primary focus of regional water planning. However, another important goal of water planning is the long-term protection of resources that contribute to water availability, and to the quality of life in the State. The purpose of this chapter is to describe how the 2011 Update to the Region B Water Plan is consistent with the long-term protection of the state's water resources, agricultural resources, and natural resources. The requirement to evaluate the consistency of the regional water plan with protection of resources is found in 31 TAC Chapter 357.14(2)(C), which states, in part:

> "The regional water plan is consistent with the guidance principles if it is developed in accordance with §358.3 of this title (relating to Guidelines), §357.5 of this title (relating to Guidelines for Development of Regional Water Plans), §357.7 of this title (relating to Regional Water Plan Development), §357.8 of this title (relating to Ecologically Unique River and Stream Segments), and §357.9 of this title (relating to Unique Sites for Reservoir Construction).

Chapter 7 addresses this issue by providing general descriptions of how the plan is consistent with protection of water resources, agricultural resources, and natural resources. Additionally, the chapter will specifically address consistency of the 2011 Region B Water Plan Update with the State's water planning requirements. To demonstrate compliance with the State's requirements, a matrix has been developed and will be addressed in this chapter.

7.2 Consistency with the Protection of Water Resources

The water resources in Region B include three river basins providing surface water, and three aquifers providing groundwater. The three major river basins within Region B boundaries include the Red River Basin, the Trinity River Basin, and the Brazos River Basin. The respective boundaries of these basins are depicted on Figure 2, in Chapter 1. The region's groundwater resources include, primarily, the Seymour, Blaine, and Trinity Aquifers. The extents of these aquifers within the region are depicted on Figures 3 and 4 in Chapter 1.

The source of most of the region's surface water supply is the Red River basin, which supplies much of the municipal, industrial, mining and irrigation needs in the region. Amon Carter Lake in the Trinity River Basin is a major reservoir in the southeast part of the region. Small amounts of irrigation water are supplied from the Brazos River basin. Currently, approximately 98 percent of all available surface water supply in Region B comes from the Red River Basin. With the addition of Lake Ringgold this will increase to more than 99 percent.

The Seymour Aquifer is, by far, the most important groundwater resource in Region B. Over 50 percent of total available groundwater supply in the region comes from the Seymour. Most of the remainder of available supply (approximately 45 percent) is from the Blaine, although much of this resource is currently not useable due to excessive naturally occurring dissolved minerals.

To be consistent with the long-term protection of water resources, the plan must recommend strategies that minimize threats to the region's sources of water over the planning period. The water management strategies identified in Chapter 4 were evaluated for threats to water resources. The recommended strategies represent a comprehensive plan for meeting the needs of the region while effectively minimizing threats to water resources. Descriptions of the major strategies and the ways in which they minimize threats include the following:

- Water Conservation. Strategies for water conservation have been recommended that will help reduce the demand for water, thereby reducing the impact on the region's groundwater and surface water sources. Municipal water conservation practices are expected to save approximately 1,668 acre-feet of water annually, reducing impacts on both groundwater and surface water resources. The plan also assumes an additional 2,500 acre-feet per year in reduction of municipal demands due to the implementation of water conserving plumbing codes.

- City of Bowie Wastewater Reuse. This strategy will provide highly treated wastewater effluent for various irrigation and other needs in the City of Bowie. This strategy will effectively reduce the impact on the City's current source of supply, Lake Amon Carter.
- Irrigation Canal Improvements. This strategy will reduce water losses in the laterals that deliver irrigation water to farms by enclosing the laterals in pipes. This protects the Lake Kemp/Lake Diversion system by reducing the amount of water released to meet irrigation needs.
- Increase Water Conservation Elevation at Lake Kemp. This strategy will preserve and prolong the usability of Lake Kemp. This protects the water for agricultural uses and environmental needs, including the TPWD Fish Hatchery that receives water from the Lake Kemp/Lake Diversion system.
- Expanded Use of Groundwater. This strategy is recommended for entities with limited alternative sources and sufficient groundwater supplies to meet needs. Groundwater availability reported in the plan is the long-term sustainability of the aquifer, and is based on aquifer recharge. No strategies are recommended to use water above the sustainable level.
- Construct Lake Ringgold. This strategy will provide additional supply for Wichita Falls and other entities that will rely on Wichita Falls for water supply. The Reservoir Site Protection Study (TWDB, Report 370, Reservoir Site Protection Study, July 2008) did not identify significant environmental concerns for the site. The Consensus Criteria for Environmental Flow Needs were adopted in applying the WAM to determine that the reservoir could develop a firm yield 32,800 acre-feet per year. Detailed environmental studies will be required during the permitting and design of this reservoir. Releases for instream flows will be evaluated during reservoir permitting, along with other environmental impacts, and appropriate mitigation or adjustment of the firm yield, if needed, will be addressed during this process.

- Wichita River Diversion. This strategy will provide additional irrigation water for Wichita County Water Improvement District No. 2. Although the yield has been estimated based on the monthly WAM and diversion limits in the certificate of adjudication, actual diversions will based on daily flows and physical limitations of the diversion infrastructure. The maximum diversion rate of 18,000 gpm will need to correspond to the irrigation system lateral capacity and demand by the irrigated areas supplied from the two designated diversion points. These system limitations are likely to result in minimal impact on flows in the Wichita River downstream of the diversion points, which will be minimized further by end-of-lateral losses that return flows to the Wichita River. In addition, demands for water from the Lake Kemp/Lake Diversion system may be reduced.

7.3 Consistency with Protection of Agricultural Resources

Agriculture is an important economic cornerstone of Region B. Given the relatively low rainfall, irrigation is a critical aspect of agriculture in the region. The source of most of the region's irrigation is the Lake Kemp/Lake Diversion system, which provides water via a canal system located in Archer, Wichita, and Clay Counties.

Protection of the Lake Kemp/Lake Diversion system has been a central focus of the water planning process for Region B. Water losses and environmental conditions in the Southside Canal system was the subject of a major study performed as part of the 2006 Region B Plan (Biggs and Mathews, Region B Regional Water Plan, January 2006). The study identified strategies for reducing losses, and for reducing environmental threats to the canal. A second study sponsored by Region B and funded by the TWDB (Biggs and Mathews, Region B: Wichita County Water improvement District No. 2 Water Conservation implementation Plan, November 2008) developed specific priorities for conversion of laterals to pipelines with estimates of water conservation and project costs. The results of these efforts have been incorporated into this 2011 Region B Plan Update, and one of the recommended water management strategies includes enclosing portions of the laterals in pipelines to conserve water.

Construction of Lake Ringgold will inundate approximately 15,400 acres of land at conservation storage capacity. This includes 756 acres of agricultural land, 8,020 acres of grassland, 1,942 acres of shrubland, and 4,316 acres of deciduous forests, and 335 acres of open water (TWDB, Report 370, Reservoir Site Protection Study, July 2008). The impacts to agricultural land are expected to be more than offset by the benefits in terms of water supply that may supplement agriculture.

The Wichita River Diversion may serve to help sustain irrigated agriculture in areas already served by the Wichita County Water Improvement District No. 2.

7.4 Consistency with Protection of Natural Resources

Region B contains many natural resources that must be considered in water planning. Natural resources include threatened or endangered species; local, state, and federal parks and public land; and energy/mineral reserves. The Region B Water Plan is consistent with the long-term protection of these resources. Following is a brief discussion of consistency of the plan with protection of natural resources.

7.4.1 Threatened/Endangered Species

A list of threatened or endangered species located within Region B is contained in Table 1-13, in Chapter 1. Included are 9 species of birds, two mammals, two reptiles, and one fish. None of the water management strategies evaluated for the Region B Water Plan is expected to adversely impact the listed species.

7.4.2 Parks and Public Lands

Two State Parks (Copper Breaks and Lake Arrowhead) and one State Wildlife Management Area (Matador) are located in Region B. In addition, there are a number of city parks, recreational facilities, and public lands located throughout the region. None of the water management strategies evaluated for the Region B Water Plan is expected to adversely impact parks or public land. The development of wastewater reuse for the City of Bowie could reduce reliance on water from Lake Amon Carter, and reducing the need for future diversion from this lake may enhance recreation. In addition, the construction of Lake Ringgold is expected to offer additional opportunities for development of parks and recreational facilities

7.4.3 Energy Reserves

There are over 30,000 producing oil and gas wells located within Region B, representing an important economic base for the region. None of the water management strategies is expected to significantly impact oil or gas production in the region.

7.4.4 Navigation

Since there are no navigable waterways located in Region B, none of the Management Strategies are expected to impact navigation.

7.5 Consistency with State Water Planning Guidelines

To be considered consistent with long-term protection of the State's water, agricultural, and natural resources, the Region B Water Plan must be determined to be in compliance with the following regulations:

- 31 TAC Chapter 358.3
- 31 TAC Chapter 357.5
- 31 TAC Chapter 357.7
- 31 TAC Chapter 357.8
- 31 TAC Chapter 357.9

The information, data, evaluation, and recommendations included in Chapters 1 through 6 and Chapter 8 of the Region B Water Plan collectively comply with these regulations. To assist with demonstrating compliance, Region B has developed a matrix addressing the specific recommendations contained in the above referenced regulations.

The matrix is a checklist highlighting each pertinent paragraph of the regulations. The content of the Region B Water Plan has been evaluated against this matrix. Attachment 7-1 contains a completed matrix.

ATTACHMENT 7-1

REGIONAL WATER PLANNING GROUP B

CHECKLIST FOR COMPARISON OF THE REGIONAL WATER PLAN TO APPLICABLE WATER PLANNING REGULATIONS

ATTACHMENT 7-1

CHECKLIST FOR COMPARISON OF THE REGIONAL WATER PLAN TO APPLICABLE WATER PLANNING REGULATIONS

The purpose of this attachment is to facilitate the determination of how the Regional Water Plan is consistent with the long-term protection of the water, agricultural, and natural resources of the State of Texas, particularly within this region. The following checklist includes a regulatory citation (Column 1) for all subsections and paragraphs contained in the following applicable portions of the water planning regulations:

- 31 TAC Chapter 358.3
- 31 TAC Chapter 357.5
- 31 TAC Chapter 357.7
- 31 TAC Chapter 357.8
- 31 TAC Chapter 357.9

According to 31 TAC Chapter 357.14(b), the Regional Water Plan is considered to be consistent with the long-term protection of the State's resources if it complies with the above listed requirements. Therefore, the Regional Water Plan has been compared to each applicable section of the regulations as a means of determining consistency.

The checklist also includes a summary description of each cited regulation (Column 2). It should be understood that this summary is intended only to provide a general description of the particular section of the regulation and should not be assumed to contain all specifics of the actual regulation. The evaluation of the Regional Water Plan should be performed against the complete regulation, as contained in the actual 31 TAC 358 and 31 TAC 357 regulations.

Column 3 of the checklist provides the evaluation response as affirmative, negative, or not applicable. A "Yes" in this column indicates that the Region B Regional Water Planning Group believes the Regional Water Plan complies with the stated section of the regulation. A “No” response indicates that the Region B Regional Water Planning Group believes the Regional Water Plan does not comply with the stated regulation. A response of “NA” (or not applicable) indicates that the stated section of the regulation does not apply to the Regional Water Plan.

The evidence of where, in the Regional Water Plan, the stated regulation is addressed is provided in Column 4. Where the regulation is addressed in multiple locations within the Regional Water Plan, this column may cite only the primary locations. In addition to identifying where the regulation is addressed, this column may include commentary about the application of the regulation in the Regional Water Plan.

The above-listed regulations are repetitive, in some instances. One section of the regulations may be restated or paraphrased elsewhere within the regulations. In some cases, multiple sections of the regulations may be combined into one separate regulation section. Column 5 indicates cross-referencing for water planning regulations.

CHECKLIST FOR COMPARISON OF THE REGIONAL WATER PLAN TO APPLICABLE WATER PLANNING REGULATIONS

Regulatory Citation (Col 1)	Summary of Requirement (Col 2)	Response (Yes/No/ NA) (Col 3)	Location(s) in Regional Plan and/or Commentary (Col 4)	Regulatory Cross References (Col 5)
31 TAC §358.3				
(a)	TWDB shall develop a State Water Plan (SWP) with 50-year planning cycle, and based on the Regional Water Plan (RWP)	NA	Applies to the State Water Plan. The Regional Water Plan is based on a 50-year planning cycle, however.	
(b)	RWP is guided by the following principles			
(b)(1)	Identified policies and actions so that water will be available at reasonable cost, to satisfy reasonable projected use and protect resources	Yes	Chapters 4, 6, and 8	§358.3(b)(4), §357.5 (a); §357.7 (a)(9), §357.7 (a)(10), §357.7 (e)(1),
(b)(2)	Open and accountable decision-making based on accurate, objective information	Yes	Regular public meetings of the RWPG; Public hearing for initially prepared RWP	§357.5 (e)(6)
(b)(3)	Consideration of effects of plan on the public interest, and on entities providing water supply	Yes	Chapter 4, 5, and 7	
(b)(4)	Consideration and approval of cost-effective strategies that meet needs and respond to drought, and are consistent with long-term protection of resources	Yes	Chapters 4, 6, and 7	§358.3(b)(1), §357.5 (e)(4) and §357.5 (e)(6); §357.7(a)(9)
(b)(5)	Consideration of opportunities that encourage the voluntary transfer of water resources	Yes	Chapter 4	
(b)(6)	Consideration and approval of a balance of economic, social, aesthetic, and ecological viability	Yes	Chapters 4 and 7	
(b)(7)	The use of information from the adopted SWP for regions without a RWP	NA		
(b)(8)	The orderly development, management, and conservation of water resources	Yes	Chapters 4 and 6	§357.5(a)
(b)(9)	Surface waters are held in trust by the State, and governed by doctrine of prior appropriation	Yes	Chapters 3 and 4	
(b)(10)	Existing water rights, contracts, and option agreements are protected	Yes	Chapter 4	§357.5(e)(3)
(b)(11)	Groundwater is governed by the right of capture unless under local control of a groundwater conservation district	Yes	Chapters 1 and 4	
(b)(12)	Consideration of recommendation of stream segments of unique ecological value	Yes	Chapter 8. The RWPG decided to not recommend any of the Region's stream segments for designation as a segment of unique ecological value	§357.8

Regulatory Citation (Col 1)	Summary of Requirement (Col 2)	Response (Yes/No/ NA) (Col 3)	Location(s) in Regional Plan and/or Commentary (Col 4)	Regulatory Cross References (Col 5)
(b)(13)	Consideration of recommendation of sites of unique value for the construction of reservoirs	Yes	Lake Ringgold is a designated reservoir site of unique value in the 2007 State Water Plan. The RWPG decided to not recommend additional locations as sites of unique value for construction of reservoirs.	§357.9
(b)(14)	Local, regional, state, and federal agency water planning coordination	Yes	The regional water planning process has included all levels of coordination, as necessary	
(b)(15)	Improvement or maintenance of water quality and related uses as designated by the State Water Quality Plan	Yes	Chapters 4 and 5	
(b)(16)	Cooperation between neighboring water planning regions to identify common needs and issues	Yes	The regional water planning process has included coordination with neighboring regions, as needed	
(b)(17)	WMS described sufficiently to allow a state agency making financial or regulatory decisions to determine consistency of the WMS with the RWP	NA	Chapter 4	§357.7(a)(9)
(b)(18)	Environmental evaluations are based on site-specific information or state environmental planning criteria	Yes	Chapter 4. To the extent that such information is available	§357.5(e)(1); §357.5 (e)(6); §357.5(k)(1)(H)
(b)(19)	Consideration of environmental water needs, including instream flows and bay and estuary inflows	Yes	Chapters 3 and 4	§357.5(e)(1); §357.5(l); §357.7 (a)(8)(A)(ii)
(b)(20)	Planning is consistent with all laws applicable to water use for state and regional water planning	Yes	The regional water planning process has considered applicable water laws.	§357.5(f)
(b)(21)	Ongoing permitted water development projects are included	Yes	Chapters 1, 3, and 4	
31 TAC §357.5				
(a)	The RWP: provides for the orderly development, management, and conservation of water resources; prepares for drought conditions; and protects agricultural, natural, and water resources	Yes	Chapters 4, 6, and 7	§357.7(a)(8)(A)(ii), §358.3(b)(1), §358.3(b)(18), §358.3(b)(19)
(b)	The RWP submitted by January 5, 2011	NA	To be submitted	
(c)	The RWP is consistent with 31 TAC §358 and 31 TAC §357, and guided by state and local water plans	Yes	Chapter 7 and throughout the RWP	

Regulatory Citation (Col 1)	Summary of Requirement (Col 2)	Response (Yes/No/ NA) (Col 3)	Location(s) in Regional Plan and/or Commentary (Col 4)	Regulatory Cross References (Col 5)
(d)(1)&(2)	The RWP uses state population and water demand projections from the SWP; or revised population or water demand projections that are adopted by the State	Yes	Chapter 2. Population of the Region B Regional Water Planning Area did not change in this round, per TWDB projections. Changes in water demands are consistent with TWDB projections.	
(e)(1)	The RWP provides WMS adjusted for appropriate environmental water needs; environmental evaluations are based on site-specific information or state environmental planning criteria	Yes	Chapter 4, to the extent that site-specific information was available.	§358.3(b)(1); §358.3(b)(18); §358.3(b)(19), §357.7 (a)(8)(A)(ii)
(e)(2)	The RWP provides WMS that may be used during a drought of record	Yes	Chapter 4	
(e)(3)	The RWP protects existing water rights, contracts, and option agreements	Yes	Chapters 3 and 4	§358.3(b)(10)
(e)(4)	The RWP provides cost-effective and environmentally sensitive WMS based on comparisons of all potentially feasible WMS; The process is documented and presented to the public for comment.	Yes	Chapter 4; WMS have been presented to the public and adopted by, the RWPG on November 4, 2009.	§358.3(b)(4)
(e)(5)	The RWP incorporates water conservation planning and drought contingency planning	Yes	Chapters 4 and 6	§357.5(k)(1)(A)&(B); §357.7(a)(7)(B)
(e)(6)	The RWP achieves efficient use of existing supplies and promotes regional water supplies or regional management of existing supplies; Public involvement is included in the decision-making process	Yes	Chapters 4 and 6. Regular public meetings held to discuss WMS and conservation issues.	§358.3(b)(2), §358.3(b)(4), §358.3(b)(18)
(e)(7)(A)&(B)	The RWP identifies (A) drought triggers, and (B) drought responses for designated water supplies	Yes	Chapter 6	§357.5(e)(5); §357.5(k)(1)(A)&(B)
(e)(8)	The RWP considers the effect of the plan on navigation	Yes	No navigable streams in the Region B Regional Water Planning Area.	
(f)	Planning is consistent with all laws applicable to water use in the Region	Yes	The regional water planning process has considered applicable water laws in development of the RWP	§358.3(b)(20)
(g)	The following characteristics of a candidate special water resource are considered:			
(g)(1)	The surface water rights are owned by an entity headquartered in another region.	NA	No Special Water Resources (as defined in §357) exist in the Region at this time. Greenbelt Lake is a special resource located in Region A and used in Region B.	

Regulatory Citation (Col 1)	Summary of Requirement (Col 2)	Response (Yes/No/ NA) (Col 3)	Location(s) in Regional Plan and/or Commentary (Col 4)	Regulatory Cross References (Col 5)
(g)(2)	A water supply contract commits water to an entity headquartered in another region.	NA		
(g)(3)	An option agreement may result in water being supplied to an entity headquartered in another region.	NA		
(h)	Water rights, contracts, and option agreements of special water resources are protected in the RWP	NA		
(i)	The RWP considers emergency transfers of surface water rights	NA	No emergency transfers of water are anticipated in this plan update.	
(j)(1)-(3)	Simplified planning is used in the RWP in accordance with TWDB rules	NA	A normal water planning process is used in the Region	
(k)(1)&(2)	The RWP shall consider existing plans and information, and existing programs and goals related to local or regional water planning	Yes	Chapters 1 through 6	§358.3(b)(18); §357.7 (e)(5), §357.7 (e)(7), §357.7 (a)(1)(A)(M)
(l)	The RWP considers environmental water needs including instream flows and bays and estuary flows	Yes	Chapter 4	§358.3(b)(19); §357.7 (a)(8)(A)(ii)
31 TAC §357.7				
(a)(1)(A)-(M)	The RWP shall describe the region, including specific requirements of paragraphs A through M of this section of the regulations	Yes	Chapters 1, 4, and 6.	§357.7(a)(8)(A)(iii); §357.7(a)(8)(D); §357.5(k)(1)(C); §357.7(a)(7)(A)(iv)
(a)(2)(A)-(C)	The RWP includes a presentation of current and projected population and water demands, reported in accordance with paragraphs A through C of this section of the regulations	Yes	Chapter 2	
(a)(3)(A)&(B)	The RWP includes the evaluation of current water supplies available (including a presentation of reservoir firm yields) to the Region for use during drought of record conditions, reported by the type of entity and wholesale providers	Yes	Chapter 3	
(a)(4) (A)&(B)	The RWP includes water supply and demand analysis, comparing the type of entity and wholesale providers	Yes	Chapter 4	
(a)(5)(A)-(C)	The RWP provides sufficient water supply to meet the identified needs, in accordance with requirements of paragraphs A through C of this section of the regulations	Yes	Chapter 4	

Regulatory Citation (Col 1)	Summary of Requirement (Col 2)	Response (Yes/No/ NA) (Col 3)	Location(s) in Regional Plan and/or Commentary (Col 4)	Regulatory Cross References (Col 5)
(a)(6)	The RWP presents data required in paragraphs (2) - (5) of this subsection in subdivisions of the reporting units required, if desired by the RWPG	Yes	Chapters 2, 3, and 4	
(a)(7)(A)-(G)	The RWP evaluates all WMS determined to be potentially feasible, in accordance with paragraphs A through G of this section of the regulations	Yes	Chapter 4.	§357.5(k)(1)(C); §357.7(a)(1)(M); §357.5(e)(5); §357.5(k)(1)(B)
(a)(8)(A)-(H)	The RWP evaluates all WMS determined to be potentially feasible, by considering the requirements of paragraphs A through H of this section of the regulations	Yes	Chapter 4	§358.3(b)(19); §357.5(e)(1); §357.5(l); §357.7(a)(1)(L); §357.7(a)(8)(D); §357.7(a)(8)(A)(iii);
(a)(9)	The RWP makes specific recommendations of WMS in sufficient detail to allow state agencies to make financial or regulatory decisions to determine the consistency of the proposed action with an approved RWP	NA	Chapter 4	§358.3(b)(1); §358.3(b)(4); §358.3(b)(17)
(a)(10)	The RWP includes regulatory, administrative, or legislative recommendations to facilitate the orderly development, management, and conservation of water resources; prepares for drought conditions; and protects agricultural, natural, and water resources	Yes	Chapters 4, 6, and 7	§358.3(b)(1) §357.5(a)
(a)(11)	The RWP includes a chapter consolidating the water conservation and drought management recommendations	Yes	Chapter 6	
(a)(12)	The RWP includes a chapter describing the major impacts of recommended WMS on key parameters of water quality	Yes	Chapter 5	
(a)(13)	The RWP includes a chapter describing how it is consistent with long-term protection of the state's water, agricultural, and natural resources	Yes	Chapter 7	
(a)(14)	The RWP includes a chapter describing the financing needed to implement the water management strategies recommended	NA	Will be provided (Chapter 9)	
(b)	The RWP excludes WMS for political subdivisions that object to inclusion and provide reasons for objection	NA		
(c)	The RWP includes model water conservation plan(s)	Yes	Chapter 6.	
(d)	The RWP includes model drought contingency plan(s)	Yes	Chapter 6.	
(e)	The RWP includes provisions for assistance of the TWDB in performing regional water planning activities and/or resolving conflicts within the Region	NA	No known conflicts within the region	

Regulatory Citation (Col 1)	Summary of Requirement (Col 2)	Response (Yes/No/ NA) (Col 3)	Location(s) in Regional Plan and/or Commentary (Col 4)	Regulatory Cross References (Col 5)
31 TAC §357.8				
(a)	The RWP considers the inclusion of recommendations for the designation of river and stream segments of unique ecological value within the Region	Yes	Chapter 8. The RWPG decided to not recommend any of the Region's stream segments for designation as a segment of unique ecological value	§358.3(b)(12)
(b)	If river or stream segments of unique ecological value are recommended, such recommendations are made in the plan on the basis of the criteria established in this section of the regulations	NA		
(c)	If the RWP recommends designation of river or stream segments of unique ecological value, the impact of the regional water plan on these segments is assessed	NA		
31 TAC §357.9				
(1)	The RWP considers the inclusion of recommendations for the designation of sites of unique value for construction of reservoirs	Yes	Lake Ringgold is a designated reservoir site of unique value in the 2007 State Water Plan. The RWPG decided to not recommend additional locations as sites of unique value for construction of reservoirs.	§358.3(b)(13)
(2)	If sites of unique value for construction of reservoirs are recommended, such recommendations are made in the plan on the basis of criteria established in this section of the regulations	NA		

CHAPTER 8

RECOMMENDATIONS INCLUDING UNIQUE ECOLOGICAL STREAM SEGMENTS, RESERVOIR SITES, LEGISLATIVE & REGIONAL POLICY ISSUES

TEXAS STATE WATER PLAN

REGION B

SEPTEMBER 2010

RECOMMENDATIONS INCLUDING UNIQUE ECOLOGICAL STREAM SEGMENTS, RESERVOIR SITES, LEGISLATIVE & REGIONAL POLICY ISSUES
TEXAS STATE WATER PLAN
REGION B

8.1 Introduction

With the passage of Senate Bill 1, the 75th Legislature established a regional process to plan for the water needs of Texas. As a part of this planning process, the Texas Water Development Board created 16 regional water planning groups and implemented rules and regulations to govern the process on a regional basis.

In accordance with Senate Bill 1 and Senate Bill 2 the Region B Planning Group has revised and refined their previously approved Regional Water Plan in an effort to respond to changed conditions that may impact estimated demands for water, water supplies or recommended water strategies.

Region B, as designated by Senate Bill 1, is comprised of 10 counties and a portion of another in North Central Texas.

As a part of the revised plan, this chapter identifies and makes recommendations that the Regional Water Planning Group deems vital to the management and conservation of the water resources in Region B.

8.2 Discussion of Regional Issues

In addition to the specific water management strategies recommended for Region B in Chapter 4 of the plan, there were several other issues that the Regional Water Planning Group deemed to be significant water management concepts to be given further consideration as part of the Region B Plan. The Chloride Control Project on the Wichita and Pease Rivers is a water management strategy with high regional support. Other strategies that enhance and/or increase the existing supplies in the region, such as land stewardship (brush management), groundwater recharge enhancement, weather modification, and increased conservation storage for Lake Kemp, are each potentially feasible management strategies throughout and perhaps beyond the 50 year planning horizon.

Senate Bill 1 requires future projects to be consistent with the approved regional water plan to be eligible for TWDB funding and TCEQ permitting. However, it is the intention of the RWPG that surface water uses that will not have a significant impact on the region's water supply and water supply projects that do not involve the development of or connection to a new water source are deemed consistent with the regional water plan even though not specifically recommended in the plan.

8.2.1 Chloride Control Project

Natural mineral pollutants, primarily chloride and sulfates in the upper reaches of the Red River Basin in Region B, render downstream waters unusable for most beneficial purposes. From a study initiated by the U.S. Public Health Service in 1957, it was determined that 10 natural salt source areas located in the Red River Basin contribute a daily average of about 3,300 tons of chlorides to the Red River. Subsequent to that study, in 1959 the U.S. Army Corps of Engineers proposed measures to control the natural chloride pollution by recommending control/structural facilities for 8 of the 10 salt source areas.

These recommended chloride control structures are proposed to improve the water quality conditions of the Red River and its tributaries to the extent that the water may be utilized for municipal, industrial, and agricultural uses on a regular basis.

It is anticipated that the Wichita River Basin Chloride Control Project will effectively remove 362 tons per day of the 429 tons per day of chloride entering the Wichita River System. This improved water quality will allow for full utilization of Lakes Kemp and Diversion.

Improvement in the quality of this substantial water source would increase the reliability of the City of Wichita Falls system and reduce their treatment costs. It could also facilitate more diverse and expanded agricultural use and more efficient industrial use.

Also, in the long term, as chloride control facilities are constructed on the Pease River in conjunction with the Crowell Brine Reservoir, the potential exists for another freshwater supply reservoir on the Pease River near Crowell in Foard County, with an estimated yield of 138,000 acre-feet per year.

8.2.2 Land Stewardship

Land stewardship is the practice of managing land to conserve or enhance the ecosystem values of the land. It is a benefit to the state's natural resources by improving watershed productivity through increased surface water runoff and groundwater recharge. Land stewardship is a practice that is supported and encouraged by Region B.

Some land stewardship practices that are most applicable in Region B include managed grazing, water enhancement through brush control, erosion management, riparian management, and stream bank protection. One area of concern in Region B is the encroachment of brush in the watersheds of water supply reservoirs. The U.S. Natural Resource Conservation Service (NRCS) estimates that brush in Texas uses about 10 million acre-feet of water annually compared to the 15 million acre-feet per year currently required for human use.

Though water enhancement following brush control has been investigated in several areas of Texas, the economic benefits and overall productivity of a brush control program may vary significantly depending on geology, physical characteristics of the water source that may be affected by the water enhancement efforts, quantity of brush, brush species, and potential impacts on threatened or endangered species.

Two studies have been completed within Region B which can be used to assess the feasibility of implementing a brush control program to increase watershed yield. The first study was completed jointly by the Texas State Soil and Water Conservation Board (TSSWCB) and the

Red River Authority of Texas (RRA) in December, 2000 and included approximately 1,335,040 acres of the Wichita River watershed above Lake Kemp. Subsequently, in December, 2002 the TSSWCB and RRA completed a second study which included approximately 529,280 acres of the Lake Arrowhead watershed on the Little Wichita River. In both studies, preliminary results showed that implementation of an aggressive brush control program could potentially provide a net increase in the overall watershed yield.

Based on the Lake Kemp study, a net increase in the range of 32,900 acre-feet per year to 46,330 acre-feet per year could be expected over a measured long-term average. With the implementation cost of a brush control program being $70.37 per acre of removed brush and the State funding $52.78 per acre, it is anticipated that landowners would be required to fund the remaining $17.59 per acre.

Similarly, the results of the Lake Arrowhead study showed a net increase in the overall watershed yield of approximately 151,623 acre-feet per year. With a cost of $94.12 per acre of removed brush and the State funding of $75.64 per acre, it is anticipated that the landowner would be required to fund the remaining $18.48 per acre.

Based on the results of the completed studies, the regional planning group will continue to evaluate the potential effects of land stewardship strategies, and in particular water enhancement through brush control. It is anticipated that the effectiveness of these strategies will be reflected through increased water flow and improved ecosystem components such as wildlife, livestock production, aesthetics and land values.

8.2.3 Recharge Enhancement

Recharge enhancement is the process in which surface water is purposefully directed to areas where permeable soils or fractured rock allow rapid infiltration of the surface water into the subsurface to increase localized groundwater recharge. This would include any man-made structure that would slow down or hold surface water to increase the probability of groundwater recharge.

In Region B, groundwater is a major source of water for much of the western portion of the region. The Seymour Aquifer, which is generally unconfined, is fairly responsive to local recharge and may benefit from enhanced recharge programs. Further study is needed to determine the applicability of such programs in Region B, the quantity of increased groundwater supplies that may result from enhanced recharge, and the potential impacts to existing surface water rights.

8.2.4 Weather Modification

Weather modification is an attempt to increase the efficiency of a cloud to produce precipitation. Efforts to enhance rainfall in Texas began in 1880 and have continued to present day. Several weather modification programs are in place in areas to the west of Region B. While research has suggested increases of 15 percent or more of rainfall in areas participating in weather modification, some areas in west Texas have shown greater increases in rainfall, particularly during non-drought years. Weather modification programs in Region B could potentially increase surface runoff to reservoirs, reduce irrigation demands, and increase recharge to groundwater sources. Based on existing programs, the cost of operating a weather modification program is approximately 10 cents per acre.

8.2.5 Increase Conservation Storage for Lake Kemp

The U.S. Army Corps of Engineers (USACE) constructed Lake Kemp for flood control and water supply. It is located in an area with relatively high sedimentation rates, and as a result, the firm yield of the reservoir is expected to decrease significantly over the planning period. With the completion of the chloride control project, water quality in the Wichita basin is expected to improve such that the water from Lake Kemp will become more desirable for existing and future users.

The USACE has provisions to transfer a portion of the flood storage to conservation storage to compensate for siltation, if there is a need for water supply. Since there is regional concern over the long-term quantity of supply from Lake Kemp, it is recommended that Region B pursue transferring flood storage to conservation storage. This is a recommended water management strategy for the region.

8.2.6 Sediment Control Structures

The accumulation of sediment in existing reservoirs can have a significant impact on the reliable supply from those reservoirs over time. For Region B reservoirs, there is a projected reduction in reservoir yield of 67,400 acre-feet per year over the 60-year period from 2000 to 2060. Most of this reduction is associated with sediment accumulation in Lake Kemp.

Since the 1950s numerous dams and structures in Texas have been constructed to help reduce the amount of sediment carried downstream into water supply sources. Many of these structures are approaching the end of their useful life and will require rehabilitation or new structures. Studies conducted by the Tarrant Regional Water District in the Trinity River Basin estimate that existing Natural Resources Conservation Service (NRCS) control structures provide considerable reductions in sediment loading to downstream reservoirs. In the West Fork System watershed, the cost per acre-foot of sediment retained was estimated by the District at $435. Based on the projected sediment accumulation in the lakes and the corresponding reduction in yield, the cost of water saved would be about $200 per acre-foot. This indicates sediment control structures can be very cost effective in selected watersheds. The control of sediment by these NRCS structures can also have water quality benefits for downstream streams and reservoirs.

The Wichita River Basin in Region B could potentially benefit from sediment control structures and other land management practices that reduce sediment loading to streams. The Region B Planning Group recommends that the state support both federal and state efforts to rehabilitate existing sediment control structures and encourage funding and support for the construction of new structures and other land management practices in watersheds that would produce the greatest benefits.

8.3 Designation of Unique Stream Segments and Reservoir Sites

In accordance with TAC Section 357.8, the Regional Water Planning Group is not required, but may include in the adopted regional water plan recommendations for river and stream segments of unique ecological value, in addition to unique sites for reservoir construction. Such designation would provide for protection of these specific sites to the extent that a state agency or political subdivision may not obtain a fee title or an easement that would destroy the unique ecological value of the designated stream segment or significantly prevent the construction of a reservoir on a designated site.

8.3.1 Unique Stream Segments

Within Region B, the Texas Parks & Wildlife (TPWD) has suggested that certain stream segments of the Middle Pease River in Cottle County, the Pease River in Foard County, and the Red River from the Wichita/Clay County line upstream through Hardeman County be considered for recommendation as stream and/or river segments of unique value. The TPWD believes that each of these segments satisfy at least one of the designation criteria defined in Senate Bill 1.

Of the stream segments suggested by the TPWD, two are located within areas that currently offer protections and one segment lies in Oklahoma:

- Middle Pease River segment is located in the Matador Wildlife Management Area
- Pease River segment is located in Copper Breaks State Park
- Red River segment is located in Oklahoma

The Region B Water Planning Group is committed to the protection and conservation of unique and sensitive areas within the region. To that end, the consensus of the planning group is that a more comprehensive study with supporting data is necessary to accurately characterize and evaluate the listed stream/river segments or other stream segments in order to determine whether it is appropriate to recommend segment for designation as being unique.

There is still some concern as to the impact of the designation and it is not clear what governmental or private activities, other than reservoir construction, might be subject to additional constraints or limitations as a result of unique stream segment designation. It is also not clear what geographic extent might be impacted by the designation. For example, is the entire watershed of the designated stream subject to additional limitations, and how far upstream of the designated stream would limitations apply? The Region B Water Planning Group suggests that the Legislature may wish to clarify their intent regarding the designations.

8.3.2 Reservoir Sites

It is generally recognized that studies over the last 40 years have identified perhaps the last remaining reservoir site within Region B in which the water quality of the watershed is adequate for municipal use. This site, known as the Ringgold Reservoir site, is located on the Little Wichita River in Clay County, approximately one half mile upstream from the confluence with the Red River.

This site is recognized as a site of unique value in the 2007 State Water Plan and is currently protected under the provisions of §16.051 of the Texas Water Code as amended by SB3 of the 80th Legislature. Lake Ringgold is a recommended water management strategy for Wichita Falls (Chapter 4); although, it is not required until 2050. The Region B Water Planning Group suggests that the Legislature extend the protections for unique reservoir sites beyond the current expiration date of September 1, 2015, to ensure that reservoir sites such as Lake Ringgold that are identified as water management strategies but not required until late in the planning period remain protected until applications and permits are filed.

8.4 Discussion of Regulatory and Legislative Actions

To facilitate the orderly development, management, and conservation of water resources within the region, and to assist the region in preparing for and responding to drought conditions, the Region B Water Planning Group believes that the regulatory agencies and legislature should consider certain actions relating to water quality and funding issues which affect Region B.

8.4.1 Regulatory Review of Nitrate MCL

In Region B, there are a number of small user groups which utilize water with nitrate levels in excess of 10 mg/l. For the most part this supply is their only source of water, and advanced treatment for the removal of nitrates is very costly. Presently these systems employ bottled water programs for customers that may be sensitive to nitrate concentrations (pregnant women and infants). This program is considered an interim measure by TCEQ until the system can comply with the nitrate standards.

It is the consensus of the Region B Water Planning Group that the regulatory agency review its MCL standards for smaller systems which have no cost effective means to comply with the current nitrate MCL of 10 mg/l, and consider funding new studies to determine the health effects of nitrates in drinking water.

In addition, the planning group requests that the regulatory agencies consider bottled water programs as a long-term strategy to meet the nitrate water quality standards, or alternatively simply provide for a waiver process.

8.4.2 Funding for Comprehensive Studies

In preparing the Region B Water Plan there are several regional water planning, management, and conservation related issues which will require additional funding for data collection and administrative activities in order to adequately assess their viability or feasibility as a cost effective management strategy for Region B. For example, additional funds are needed to further evaluate and cost-share in the implementation of brush management programs in an effort to increase water yields, to identify and designate unique stream segments and/or reservoir sites for protection of these areas, and to implement various other chloride control measures and wastewater reuse programs throughout Region B.

8.4.3 Conservation

Region B supports the efforts of the State-appointed Water Conservation Task Force, and encourages the practices of water conservation within the region and state. The Regional Water Planning Group also recognizes the differences in water use and needs among water users and different regions. Region B encourages the Legislature to allow each region to establish realistic, appropriate and voluntary water conservation goals for the region. These goals should only be established after sufficient data on water use have been collected using consistent data reporting requirements. The use of the measurement of gallons per capita per day is appropriate only for residential water use or as a guideline for historical trends for a single entity. Region B does not support the establishment of statewide standards for water use.

8.5 Summary of Regional Recommendations

In accordance with 31 TAC 357.7 (a)(9), 31 TAC 357.8, and 31 TAC 357.9, the following recommendations are proposed to facilitate the orderly development, management, and conservation of the water resources available within Region B:

- It is recommended that the Chloride Control Project on the Wichita River and the Pease River be made a regional priority in order to enhance the water quality of Lake Kemp and Lake Diversion, and reclaim those lakes as a viable cost effective short term and long term regional water supply source.

- Based on the results of the Lake Kemp and Lake Arrowhead brush management studies, it is recommended that the State consider providing adequate funding to implement brush management and other land stewardship programs in an attempt to increase watershed yields.

- Region B recommends that the state support both federal and state efforts to rehabilitate existing sediment control structures and encourage funding and support for the construction of new structures and other land management practices in watersheds that would produce the greatest sediment control benefits.

- Region B recommends that no segments be designated as "Unique Stream/River Segments" at this time. Pending the results of comprehensive studies and clarification of the significance and impacts of designation, the Regional Water Planning Group may consider designations within the region in the future.

- Region B requests that the Legislature extend the protections for unique reservoir sites beyond the current expiration date of September 1, 2015, to ensure that reservoir sites such as Lake Ringgold that are identified as water management strategies but not required until late in the planning period (2050) remain protected under the Texas Water Code until applications and permits are filed.

- It is recommended that the state regulatory agencies consider allowing continued long-term use of bottled water programs, and/or providing a waiver for small user groups that can demonstrate they have no reasonable cost-effective means to comply with the current nitrate MCL of 10 mg/l.

- It is recommended that the state fund the development, implementation, and evaluate the necessary management strategies adopted as part of this regional plan. This includes strategies identified to meet a specific need as well as general strategies to increase water supply in the region.

- It is recommended that the Legislature support the grass-roots regional water planning process enacted by SB1 and strongly encourages the process be continued with adequate state funding for all planning efforts including administrative activities and data collection.

- It is recommended that the state continue to fund agricultural water use data collection and agricultural water use management/conservation projects.

- Senate Bill 1 requires future projects to be consistent with the approved regional water plan to be eligible for TWDB funding and TCEQ permitting. It is recommended that surface water uses that will not have a significant impact on the region's water supply and water supply projects that do not involve the development of or connection to a new water source should be deemed consistent with the regional water plan even though not specifically recommended in the plan.

- With regards to conservation it is recommended that the Legislature continue to allow each region to establish realistic, appropriate, and voluntary water conservation goals as opposed to the establishment of statewide standards.

- Region B recommends that the gallons per capita per day (gpcd) calculation of water use be based on residential water use only.

CHAPTER 9

REPORT TO LEGISLATURE ON WATER INFRASTRUCTURE FUNDING RECOMMENDATIONS

TEXAS STATE WATER PLAN

REGION B

SEPTEMBER 2010

REPORT TO LEGISLATURE ON
WATER INFRASTRUCTURE FUNDING RECOMMENDATIONS
TEXAS STATE SENATE BILL 1
REGION B

9.0 Introduction

Senate Bill 2 of the 77th Texas Legislature included an Infrastructure Financing Report (IFR) to be incorporated into the regional water planning process. This IFR includes information on the costs and funding capabilities of the entities with preferred water management strategies recommended during this planning cycle. The purpose of this update is to:

- Determine the number of water user groups with identified needs for additional water supplies that will be unable to pay for their water infrastructure needs without some form of outside financial assistance;
- Determine how much of the infrastructure costs in the regional water plan cannot be paid for solely using local utility revenue sources;
- Determine financing options proposed by political subdivisions to meet future water infrastructure needs (including the identification of any state funding sources considered);
- Determine what role(s) the RWPGs propose for the state in financing the recommended water supply projects; and
- Provide policy recommendations concerning suitable alternatives for financing water infrastructures in Texas.

The two essential elements to the IFR are; (1) surveys and (2) RWPG policy recommendations on the State's role in financing water infrastructure projects.

9.1 Identification of Needs

As described in Chapter 4, water supply needs in Region B were identified for three different categories: quantity, quality, and reliability. The quantity category includes eight water user groups which were identified to have projected shortages totaling 40,366 acre-feet per year by 2060. In addition, eight municipal and manufacturing water user groups were identified as having projected safe supply shortages. Safe supply is defined as being able to meet the projected demands plus 20 percent of the demand.

The quality category includes those water user groups which have been identified as being dependent on water which does not meet primary drinking water standards and those water user groups who are dependent on high chloride supplies from Lake Kemp for agricultural use.

The reliability category includes those water user groups with physical system limitations and/or limitations in available supplies as compared to contracted peak demands. Table 9-1 shows the 17 water user groups identified with one or more of the need categories.

Table 9-1
Water Users with Identified Needs

		Water Supply Needs		
User	**County**	**Quantity**	**Quality**	**Reliability**
County Other	Archer	X		
Lakeside City	Archer	X		
Irrigation	Archer	X	X	
Baylor WSC	Baylor	X	X	X
County Other	Clay	X	X	
Charlie WSC	Clay		X	
Irrigation	Clay	X	X	
County Other	Montague	X		
Bowie	Montague	X		
Mining	Montague	X		
Irrigation	Wichita	X	X	
Iowa Park	Wichita	X		
Manufacturing	Wichita	X		
Wichita Falls	Wichita	X		
Lockett Water System	Wilbarger	X	X	X
Hinds-Wildcat System	Wilbarger		X	X
Steam Electric Power	Wilbarger	X		

9.2 Recommended Water Management Strategies

Water management strategies were developed for each of the 17 water user groups shown in Table 9-1, with input from each respective water user group. Conservation was a primary strategy for each of the water user groups indicating a need. However, in all cases it was evident that conservation alone would not meet the projected needs. Therefore, other strategies were developed based on the entities' need and supply availability and are further detailed in Sections 4.2.2 through 4.2.6 of this plan. In some cases multiple strategies for the water user group were developed and presented as preferred and alternative strategies. However, for the purpose of the IFR, only the preferred strategies were considered.

In addition to the individual water user group strategies developed, the Area B Regional Water Planning Group adopted a regional strategy which would benefit many of the water user groups in the planning area whether they indicated a need or not. This strategy is the Wichita River Basin Chloride Control Project. This project has been a major factor in area water planning for several years and once completed would result in the volume of water available for municipal and industrial purposes throughout the region, as well as make the water available for a broader range of agricultural activities. A more detailed description of the project can be found in Section 4.2.7 of this plan.

The Wichita River Basin Chloride Control Project is a regional project dependent upon 100 percent federal funding and has been in development for more than 50 years. It was not included in the list of individual water user group strategies nor is the capital cost of the project included in the projected regional costs.

Water quality is a primary concern for many users in Region B and affects water use options and treatment requirements. For the evaluations of the strategies, it was assumed that the final water product would meet existing state water quality requirements for the specified use.

The total estimated capital cost for infrastructure to meet the identified needs and implement the preferred strategies less the Wichita Basin Chloride Control project is projected to be $403,718,169.

9.3 Infrastructure Financing Surveys for Preferred Water Management Strategies

Infrastructure Financing Surveys were mailed to user groups that were determined to have a projected water quality and/or water quantity need. Although 17 of the strategies developed were identified as preferred water management strategies, only two municipal entities were formally surveyed for this report, due to guidelines set forth by the Texas Water Development Board. Of the two survey questionnaires mailed, both were returned. In addition, phone interviews were conducted with some of the entities to obtain a better understanding of the strategy implementation and determine if any conflicts were or are being encountered with each. Copies of the surveys may be viewed in Attachment 9-1.

The following Table 9-2 provides a summary of the water user groups preferred strategies, projected capital costs, proposed funding sources(s), and the amount each water user group is unable to finance internally.

Table 9-2
Preferred Water Management Strategies

Water User Group	Water Management Strategy	Capital Cost	Funding Source	Unable to Pay
Archer Co. Other	Purchase Water from Local Provider	$ 364,000	*	$ 364,000
Lakeside City	Purchase Additional Water from Wichita Falls	0	NA	0
Baylor WSC	Safe Supply from Millers Creek Reservoir	714,000	Unknown	0
Clay Co. Other	Purchase Water from Local Provider	364,000	*	364,000
Charlie WSC	Nitrate Removal Plan	200,500		200,500
Montague Co. Other	Develop Trinity and Other Aquifer Supplies	2,283,500	*	2,283,500
City of Bowie	Wastewater Reuse	1,206,500	State Bonds	0
Montague Co. Mining	Purchase Water from Local Provider	412,000	*	412,000
City of Iowa Park	Purchase Additional Water from Wichita Falls	0	NA	0
City of Wichita Falls	Construct Lake Ringgold	382,900,000	State Bonds	0
Wichita Co. Manufacturing	Purchase Additional Water from Wichita Falls	0	NA	0
Lockett Water System	Purchase Water from Local Provider	1,658,700	Federal and State Grants	1,658,700

Water User Group	Water Management Strategy	Capital Cost	Funding Source	Unable to Pay
Hinds-Wildcat Water System	Nitrate Removal Plant	446,500	Federal and State Grants	446,500
Archer, Clay, Wichita Co. Irrigation and Wilbarger Co. SEP	Increase Water Conservation Pool at Lake Kemp	130,000	Federal-100%	130,000
Wichita Co. Irrigation	Divert Water from Wichita River	5,380,000	State and Federal Grants	5,380,000
Wilbarger Co. SEP and Wichita Co. Irrigation	Enclose Canal Laterals in Pipe	7,658,469	Grants = 80% Internal = 20%	6,126,775
		$ 403,718,169		**$ 17,365,975**

* = Entities not surveyed due to aggregate users. It is assumed that individual entities will be unable to fund strategies.
NA = Entities with strategies that do not require capital.

9.4 Financing Policy Recommendations

Based on comments received from various water user groups, other entities, and the general public during this planning cycle, and keeping in line with previous Infrastructure Financing Reports, the Area B Regional Water Planning Group recommends:

> "The state funds the development and the implementation of the management strategies adopted as part of this Regional Water Plan. This includes strategies identified to meet a specific need as well as general strategies to increase water supply in the region."

The Regional Water Planning Group believes that this recommendation can be accomplished through the Texas Water Development Board's current programs with proper direction and financial appropriations from the legislature.

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Infrastructure Financing Survey Report

275: BOWIE

As part of the regional and state water planning process, regional water planning groups recommend water supply projects for each of their respective regions. The purpose of this survey is gather information from your organization regarding how you plan to finance water supply projects recommended for the 2012 state water plan, and determine whether you intend to use financial assistance programs offered by the State of Texas and administered by the Texas Water Development Board (TWDB).

The TWDB has several funding programs for water projects identified in the 2012 state water plan. Funds are targeted toward: 1) construction of water supply projects, 2) planning and design and permitting for projects that have long development time frames meaning that construction would require 5-10 years of planning, design and permitting, and 3) projects that would be built with excess capacity intended to meet future water needs. These programs offer various attractive financing options such as subsidized interest rates, deferral of principal and interest during planning, design and permitting phase, partial deferral of interest and principal for those portions of the project which are optimally sized for future needs. Additionally, grant funding is available for those service areas which qualify as rural or economically disadvantaged. More information on these financial assistance programs (i.e., the Water Infrastructure Fund, the State Participation Fund, and the Economically Disadvantaged Areas Program) can be found at the TWDB website at:

http://www.twdb.state.tx.us/assistance/financial/financial_main.asp

Your cooperation and responses to these questions are crucial in helping the state in ensuring that our communities and our citizens have adequate water supplies. If you have any questions related to the financial programs offered by the TWDB or about the survey questions, please contact Curtis Campbell by phone at (940)723-2236 or by email at ccampbell@rra.dst.tx.us. If you have any computer or technology related problems with the survey, please contact Wendy Barron by phone at (512) 936-0886 or by email at wendy.barron@twdb.state.tx.us.

Section 1: Project Financing Information

For project(s) identified in the State Water Plan, the TWDB has funding available for different aspects of a project. The different programs available are:

- •WIF-Deferred offers subsidized interest and deferral of principal and interest for up to 10 years for planning, design and permitting costs.

- •WIF-Construction offers subsidized interest for all construction costs, including planning, acquisition, design, and construction.

- •State Participation funding offers partial interest and principal deferral for the incremental cost of project elements which are designed and built to serve needs beyond 10 years.

- •Rural areas funding offers grants and 0% interest loans for service areas which are not in a Metropolitan Statistical Area (MSA) and in which the population does not exceed 5,000. The service area must also meet the EDAP eligibility criteria.

- •Economically Distressed Areas Program (EDAP) offers funding through grants and loans for service areas within a project which meet the EDAP eligibility criteria. Eligibility for the TWDB's EDAP requires that the median household income of the area to be served by the proposed project be less than 75 percent of the Texas median household income ($39,927), as shown in the 2000 Census. EDAP eligibility also requires adoption of Model Subdivision rules by the appropriate planning entities.

- •State Participation funding offers partial interest and principal deferral for the incremental cost of project elements which are designed and built to serve needs beyond 10 years.

If you are interested in receiving funds from the above programs, please complete the remainder of the survey.

Infrastructure Financing Survey Report

Please enter only the amounts you wish to receive from TWDB program in the Project Costs fields and do not enter a specific project cost more than once.

Section 2: Projects

For each of the project(s) listed below, please enter only the amounts you wish to receive from TWDB programs in the 'Cost' field and the earliest date you wish to receive these amounts. In addition, the total amount entered into all five categories cannot exceed the total cost of the project. Each of the five categories corresponds to a funding program available at the TWDB. Each of the funding programs and categories are described below.

•Planning, design, permitting: Enter costs into the 'Planning, design, permitting' category if you want to participate in the WIF-Deferred program. The WIF-Deferred program offers subsidized interest and deferral of principal and interest for up to 10 years for planning, design and permitting costs.

•Acquisition and construction: Enter costs into the 'Acquisition and construction' category if you want to participate in the WIF-Construction program. The WIF-Construction program offers subsidized interest for all construction costs, including planning, acquisition, design, and construction.

•Excess Capacity: Enter costs into the 'Excess capacity' category if you want to participate in the State Participation program. State Participating funding offers partial interest and principal deferral for the incremental cost of project elements which are designed and built to serve needs beyond 10 years.

•Rural: Enter costs into the 'Rural' category if you want to participate in the Rural areas funding program. Rural areas funding offers grants and 0% interest loans for service areas which are not in a Metropolitan Statistical Area (MSA) and in which the population does not exceed 5,000. The service area must also meet the EDAP eligibility criteria.

•Disadvantaged: Enter costs into the 'Disadvantaged' category if you want to participate in the Economically Distressed Areas Program (EDAP). EDAP offers funding through grants and loans for service areas within a project which meet the EDAP eligibility criteria. Eligibility for the TWDB's EDAP requires that the median household income of the area to be served by the proposed project be less than 75 percent of the Texas median household income ($39,927), as shown in the 2000 Census. EDAP eligibility also requires adoption of Model Subdivision rules by the appropriate planning entities.

99 - WASTEWATER REUSE **$1,206,500.00**

Planning, design, permitting	Cost:	341,500	Year:	2030
Acquisition and contruction	Cost:	875,000	Year:	2035
Excess Capacity	Cost:		Year:	
Rural	Cost:		Year:	
Disadvantaged	Cost:		Year:	
	Total:			

Infrastructure Financing Survey Report

Section 3: Contact Information

1.	Name:	JAMES R. CANTWELL
2.	Phone Number:	940 872 1114 x 30
3.	Email:	jcantwell@cityofbowietx.com
4.	Comments	ESTIMATES AND TIMING TAKEN FROM REGION B REGIONAL WATER PLAN - MARCH 2010

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Infrastructure Financing Survey Report

160: WICHITA FALLS

As part of the regional and state water planning process, regional water planning groups recommend water supply projects for each of their respective regions. The purpose of this survey is gather information from your organization regarding how you plan to finance water supply projects recommended for the 2012 state water plan, and determine whether you intend to use financial assistance programs offered by the State of Texas and administered by the Texas Water Development Board (TWDB).

The TWDB has several funding programs for water projects identified in the 2012 state water plan. Funds are targeted toward: 1) construction of water supply projects, 2) planning and design and permitting for projects that have long development time frames meaning that construction would require 5-10 years of planning, design and permitting, and 3) projects that would be built with excess capacity intended to meet future water needs. These programs offer various attractive financing options such as subsidized interest rates, deferral of principal and interest during planning, design and permitting phase, partial deferral of interest and principal for those portions of the project which are optimally sized for future needs. Additionally, grant funding is available for those service areas which qualify as rural or economically disadvantaged. More information on these financial assistance programs (i.e., the Water Infrastructure Fund, the State Participation Fund, and the Economically Disadvantaged Areas Program) can be found at the TWDB website at:

http://www.twdb.state.tx.us/assistance/financial/financial_main.asp

Your cooperation and responses to these questions are crucial in helping the state in ensuring that our communities and our citizens have adequate water supplies. If you have any questions related to the financial programs offered by the TWDB or about the survey questions, please contact Curtis Campbell by phone at (940)723-2236 or by email at ccampbell@rra.dst.tx.us. If you have any computer or technology related problems with the survey, please contact Wendy Barron by phone at (512) 936-0886 or by email at wendy.barron@twdb.state.tx.us.

Section 1: Project Financing Information

For project(s) identified in the State Water Plan, the TWDB has funding available for different aspects of a project. The different programs available are:

- WIF-Deferred offers subsidized interest and deferral of principal and interest for up to 10 years for planning, design and permitting costs.

- WIF-Construction offers subsidized interest for all construction costs, including planning, acquisition, design, and construction.

- State Participation funding offers partial interest and principal deferral for the incremental cost of project elements which are designed and built to serve needs beyond 10 years.

- Rural areas funding offers grants and 0% interest loans for service areas which are not in a Metropolitan Statistical Area (MSA) and in which the population does not exceed 5,000. The service area must also meet the EDAP eligibility criteria.

- Economically Distressed Areas Program (EDAP) offers funding through grants and loans for service areas within a project which meet the EDAP eligibility criteria. Eligibility for the TWDB's EDAP requires that the median household income of the area to be served by the proposed project be less than 75 percent of the Texas median household income ($39,927), as shown in the 2000 Census. EDAP eligibility also requires adoption of Model Subdivision rules by the appropriate planning entities.

- State Participation funding offers partial interest and principal deferral for the incremental cost of project elements which are designed and built to serve needs beyond 10 years.

If you are interested in receiving funds from the above programs, please complete the remainder of the survey.

Infrastructure Financing Survey Report

Please enter only the amounts you wish to receive from TWDB program in the Project Costs fields and do not enter a specific project cost more than once.

Section 2: Projects

For each of the project(s) listed below, please enter only the amounts you wish to receive from TWDB programs in the 'Cost' field and the earliest date you wish to receive these amounts. In addition, the total amount entered into all five categories cannot exceed the total cost of the project. Each of the five categories corresponds to a funding program available at the TWDB. Each of the funding programs and categories are described below.

•Planning, design, permitting: Enter costs into the 'Planning, design, permitting' category if you want to participate in the WIF-Deferred program. The WIF-Deferred program offers subsidized interest and deferral of principal and interest for up to 10 years for planning, design and permitting costs.

•Acquisition and construction: Enter costs into the 'Acquisition and construction' category if you want to participate in the WIF-Construction program. The WIF-Construction program offers subsidized interest for all construction costs, including planning, acquisition, design, and construction.

•Excess Capacity: Enter costs into the 'Excess capacity' category if you want to participate in the State Participation program. State Participating funding offers partial interest and principal deferral for the incremental cost of project elements which are designed and built to serve needs beyond 10 years.

•Rural: Enter costs into the 'Rural' category if you want to participate in the Rural areas funding program. Rural areas funding offers grants and 0% interest loans for service areas which are not in a Metropolitan Statistical Area (MSA) and in which the population does not exceed 5,000. The service area must also meet the EDAP eligibility criteria.

•Disadvantaged: Enter costs into the 'Disadvantaged' category if you want to participate in the Economically Distressed Areas Program (EDAP). EDAP offers funding through grants and loans for service areas within a project which meet the EDAP eligibility criteria. Eligibility for the TWDB's EDAP requires that the median household income of the area to be served by the proposed project be less than 75 percent of the Texas median household income ($39,927), as shown in the 2000 Census. EDAP eligibility also requires adoption of Model Subdivision rules by the appropriate planning entities.

95 - INCREASE WATER CONSERVATION POOL AT LAKE KEMP **$26,000.00**

Planning, design, permitting	Cost:	0.00	Year:	
Acquisition and contruction	Cost:	0.00	Year:	
Excess Capacity	Cost:	0.00	Year:	
Rural	Cost:	0.00	Year:	
Disadvantaged	Cost:	0.00	Year:	
	Total:	0.00		

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Infrastructure Financing Survey Report

101 - CONSTRUCT LAKE RINGGOLD **$382,900,000.00**

Planning, design, permitting	Cost:	57,450,000	Year:	2030
Acquisition and contruction	Cost:	325,450,000	Year:	2035
Excess Capacity	Cost:	0.00	Year:	
Rural	Cost:	0.00	Year:	
Disadvantaged	Cost:	0.00	Year:	
	Total:	382,900,000		

Section 3: Contact Information

1. Name: Russell Schreiber P.E.
2. Phone Number: 940-761-7477
3. Email: russell.schreiber@wichitafallstx.gov

4. Comments

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CHAPTER 10

ADOPTION OF PLAN

TEXAS STATE WATER PLAN

REGION B

SEPTEMBER 2010

PLAN ADOPTION AND PUBLIC PARTICIPATION
TEXAS STATE SENATE BILL 1
REGION B

10.1 Introduction

This section describes the plan approval process for the Region B Water Plan and the efforts made to encourage public participation in the planning process.

The Regional Water Planning Group - Area B (RWPG-B) agreed that public outreach and education were of paramount importance if a regional water plan was to be developed that accurately represented the regional area. To this end, a public education and outreach strategy was prepared with the goal to insure that all water users and the public were informed of each meeting and the progress of the plan's development, given an opportunity to present and discuss their concerns, and participate in the planning process.

10.2 Regional Water Planning Group

As required by Senate Bill 1 regional water planning groups were formed to guide the planning process. These groups were comprised of representatives of specific interests:

- General public
- Counties
- Municipalities
- Industrial
- Agricultural
- Environmental
- Small businesses
- Electric generating utilities
- River authorities
- Water districts
- Water utilities

Table 10-1 below lists the 17 members of the Region B Water Planning Group, the interests they represent, their organizations, and their counties.

Table 10-1

Regional Water Planning Group - Area B			
Name	**Organization**	**Interest**	**County**
Mr. Jimmy Banks	Wichita County WID #2	Water District	Wichita
Judge Charlie Bell	Foard County	County	Foard
J. K. (Rooter) Brite	Rancher	Environmental	Montague/All
Curtis W. Campbell	Red River Authority of Texas	River Authority	All
Ed Garnett		Municipal	Wilbarger
Dale Hughes	W.T. Waggoner Estate	Agriculture	Wilbarger
Mayor Robert Kincaid	City of Crowell	Municipal	Foard
Judge Kenneth Liggett	Clay County	County	Clay
Mike McGuire	Rolling Plains Groundwater Conservation District	Groundwater District	Baylor
Dean Myers	Bowie Industries, Inc.	Small Business	Montague
Kenneth Patton	AEP Region 7 Engineering	Electric Generating Utilities	Wilbarger
Jerry Payne		Public	Clay
Wilson Scaling	Scaling Ranch	Agriculture	Clay
Russell Schreiber	City of Wichita Falls	Municipal	Wichita
Dr. Pamela Stephens	Midwestern State University	Environmental	Wichita/All
Tom Stephens	Alliance Power Company	Industry	Wichita
Jeff Watts	IESI	Water Utility	Wichita

The RWPG-B Planning Board unanimously pledged to support the interest of the entire region as the primary objective in meeting the needs of the region as a whole. During the first round of planning there was an extensive public education and participation program that included drought contingency planning workshops with local water suppliers, numerous civic group and local presentations, surveys of water users in the region, as well as planning group meetings, public hearings, and an internet web site. For this update, the public education and participation program consists of:

- Planning Group Meetings and Hearings
- Internet Web Site
- Coordination with Wholesale Water Providers and Water User Groups
- Implementation of the Water Plan

10.3 Planning Group Meetings

The RWPG-B held 15 open public meetings and hearings from August 23, 2006 through August 25, 2010 with invitations going to each category of interest groups and water use entities within the region, including a current agenda for each meeting and encouraging attendance and participation in the process. The RWPG Board participated actively as a group during each meeting, relying upon information provided by its consultant group and appeared to be well informed on all matters concerning the regional planning area. A list of the public meeting dates and locations held is shown in Table 10-2.

Representatives from the Texas Water Development Board, the Texas Commission on Environmental Quality, the Texas Department of Agriculture, and the Texas Parks and Wildlife Department were regularly in attendance and other agencies were periodically represented and offered presentations. Some of these were agencies such as the U.S. Army Corps of Engineers, and State and Federal Legislators representing the local districts within the regional planning area. All meetings were posted in accordance with the Texas Open Meeting's Law, Article 6252-17, Section 3a, VATCS and 31 TAC, Section 357.12(a)(5).

During each meeting, a presentation of materials, discoveries, and relevant issues were provided for discussion and deliberation prior to receiving a vote on any specific measures, action, or strategies to be taken on the part of the RWPG-B. Members of the public were given an opportunity to participate in discussions of individual agenda items, as well as to provide public comments prior to the close of each meeting. Minutes were prepared of all meetings and filed with the secretary and the Texas Water Development Board.

Table 10-2

Region B Planning Group Meetings and Public Hearings		
DATE	**EVENT**	**LOCATION**
August 23, 2006	RWPG-B Public Hearing	Nortex RPC – Wichita Falls
August 23, 2006	RWPG-B Public Meeting	Nortex RPC – Wichita Falls
September 11, 2006	RWPG-B Public Meeting	Nortex RPC – Wichita Falls
April 4, 2007	RWPG-B Public Meeting	RRA Office – Wichita Falls
October 3, 2007	RWPG-B Public Meeting	RRA Office – Wichita Falls
April 23, 2008	RWPG-B Public Meeting	RRA Office – Wichita Falls
May 23, 2008	RWPG-B Public Meeting	RRA Office – Wichita Falls
August 20, 2008	RWPG-B Public Meeting	RRA Office – Wichita Falls
November 12, 2008	RWPG-B Public Meeting	RRA Office – Wichita Falls
April 22, 2009	RWPG-B Public Meeting	RRA Office – Wichita Falls
November 4, 2009	RWPG-B Public Meeting	RRA Office – Wichita Falls
January 6, 2010	RWPG-B Public Meeting	RRA Office – Wichita Falls
February 24, 2010	RWPG-B Public Meeting	RRA Office – Wichita Falls
April 13, 2010	RWPG-B Public Hearing	MSU – Wichita Falls
August 25, 2010	RWPG-B Public Meeting	RRA Office – Wichita Falls

10.4 Media Communications

The RWPG-B Board members promoted numerous media coverage events of issues pending before the board in an effort to encourage public involvement and heighten awareness of concerns vital to the regional planning area.

The Times and Record News (TRN) was invited to each meeting and attended most which produced good summary coverage of agenda items being considered together with actions taken by the RWPG Board.

10.5 Internet Web Page

An Internet Web Page was designed and is hosted by the RWPG's management agency, the Red River Authority of Texas. It is used to disseminate information about the water resources within the region and to publish notices of meetings, hearings, and issues being considered and addressed by the RWPG Planning Board.

The web pages are maintained and updated at least quarterly, or as needed, to publicize current information of interest and solicit input from the viewers. The web site is located under the Water Resource Management section at www.rra.dst.tx.us and is available on a 24-hour basis.

The web site contains numerous links to other pages of common interest for the viewer and begins with a front page that includes a publications library, regional data inventories, names and addresses of the Regional Planning Board, public events calendar, enabling legislation (SB-1), maps of the region, and a place for written comments to the RWPG-B.

10.6 Public Hearings and Other Public Meetings

The RWPG-B conducted one public hearing on the scope of work for the regional water plan, and another public hearing to receive comments on the Initially Prepared Water Plan for Region B. Comments, both oral and written, were transcribed from the hearing and filed with the secretary and the TWDB. The RWPG also maintains a complete record of all hearings and public meetings at the office of its management agency, the Red River Authority of Texas. The first hearing was held on August 23, 2006 at Nortex Regional Planning Commission, and the second on April 13, 2010 at Midwestern State University. The Initially Prepared Water Plan for Region B was approved by a unanimous vote of the RWPG-B Board on February 24, 2010. In addition to each member, copies of the Initially Prepared Water Plan were mailed to 11 county clerks and 11 libraries throughout the region for public review.

Additionally, the RWPG Board appointed a Technical Advisory Committee (TAC) comprised of three board members, representatives of the consultant group, the public and invited guests of various expertise for review of technical materials and matters to which the RWPG Board would ultimately have to decide upon. The TAC also qualified the consultant group and recommended selection to the RWPG Board. During the Regional Water Plan development process, the TAC met and evaluated alternatives for recommendations to the RWPG Board and discussed proposed water management strategies with the affected water use entities prior to consideration for adoption by the RWPG Board.

The TAC was instrumental in reducing confusion of sensitive matters and neutralizing controversial issues before being considered by the RWPG Board. The process was very successful and was a useful means of keeping the RWPG Board well informed concerning forthcoming matters that could develop into potentially volatile situations.

10.7 Regional Water Plan Implementation Issues

Implementation issues identified for the *Region B Water Plan* include: 1) financial issues associated with paying for the proposed capital improvements, 2) identification of the governing authorities for general regional strategies such as land stewardship, recharge enhancement and weather modification, 3) public acceptance of selected strategies, and 4) public participation in water conservation measures that were assumed in this plan.

Financial Issues

It is assumed that the entities for which strategies were developed will utilize existing financial resources, incur debt through bond sales and/or receive state-supported financial assistance. Most likely the funding of identified strategies will increase the cost of water to the customers. The economic feasibility to implement the strategies will depend on the cost increases the customer base can assume. Some strategies may not be able to be implemented without state assistance. The funding mechanisms for entities with shortages are identified as part of the Infrastructure Financing Survey. The results of this survey are incorporated in this plan as Chapter 9.

Governing Authorities

In Region B there is an identified governing authority for each of the preferred strategies discussed in Chapter 4. However, for general strategies, such as land stewardship or weather modification, no governing authority has been identified. As part of the feasibility of these strategies for Region B, a governing authority will need to be identified to implement such strategies.

Public Acceptance

The public has expressed concerns regarding using wastewater effluent for municipal supplies. Reuse strategies are proposed to meet demands for the City of Wichita Falls and the City of Bowie. While the final treated water supply from this strategy will meet or exceed the city's current water quality, the perception persists that the water would be of lesser quality. To gain public acceptance of wastewater reuse strategies for municipal use, additional public educational programs may be needed.

Public Participation

The recommended strategies developed for this plan include a significant level of conservation to be implemented over the planning period. These assumed demand reductions were applied to municipal water uses. Some of the demand reductions will occur simply through improvements in technology. However, a moderate level of public participation is required to fully realize the expected conservation. If the conservation is less than expected, then there may be additional shortages that were not identified in this plan.

APPENDIX A

REGIONAL WATER PLANNING GROUP B

WHOLESALE WATER PROVIDER SUMMARY

Wichita Falls
(Units: Acre-Feet per Year)

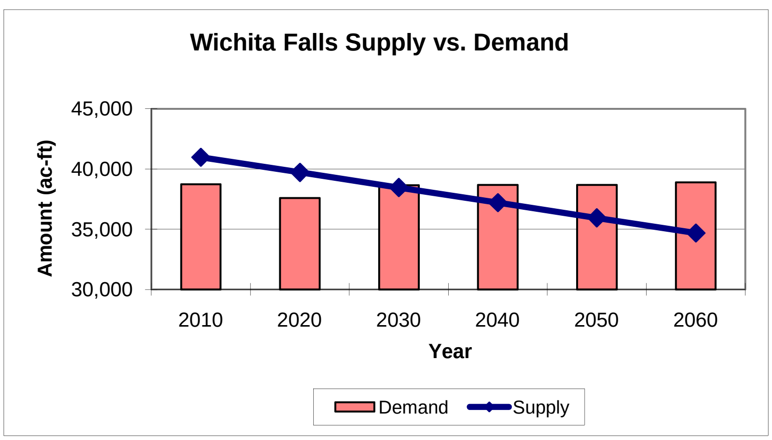
WUGs	County	Basin	Contract (mgd)	2010	2020	2030	2040	2050	2060
Wichita Falls	Wichita	Red		27,659	26,418	27,372	27,292	27,240	27,449
Archer City	Archer	Red	0.60	336	336	336	336	336	336
Archer Co. Mud #1	Archer	Red	0.15	84	84	84	84	84	84
Holliday	Archer	Red		299	310	319	320	306	295
Lakeside City	Archer	Red	0.35	196	196	196	196	196	196
Scotland	Archer	Red	0.25	140	140	140	140	140	140
Windthorst WSC	Archer	Red	0.75	420	420	420	420	420	420
Dean Dale WSC	Clay	Red	0.825	292	286	280	271	263	253
Red River Auth.	Clay	Red	0.75	420	420	420	420	420	420
Burkburnett	Wichita	Red	3.30	1,850	1,850	1,850	1,850	1,850	1,850
Dean Dale WSC	Wichita	Red		170	176	182	191	199	209
Friberg Cooper W.S.C.	Wichita	Red	0.25	140	140	140	140	140	140
Iowa Park	Wichita	Red	5.20	2,915	2,915	2,915	2,915	2,915	2,915
Pleasant Valley	Wichita	Red		120	114	112	109	108	107
Wichita Valley W.S.C.	Wichita	Red	1.85	1,037	1,037	1,037	1,037	1,037	1,037
Olney	Young	Brazos	1.00	561	561	561	561	561	561
Manufacturing	Wichita	Red		1,736	1,831	1,919	2,027	2,111	2,111
Steam Electric Power	Wichita	Red		360	360	360	360	360	360
Total Demand				**38,735**	**37,593**	**38,642**	**38,669**	**38,686**	**38,882**

Required Safe Supply for Current Customers				**38,735**	**37,593**	**38,642**	**38,669**	**38,686**	**38,882**

Potential Future Customers									
Manufacturing (additional)	Wichita	Red		357	383	409	439	462	462
Iowa Park (additional)	Wichita	Red		229	204	202	202	202	211
Lakeside City (additional)	Archer	Red		3	0	12	7	0	0

Current Supplies				**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Kickapoo	Reservoir	Red		13,592	12,934	12,276	11,618	10,960	10,300
Arrowhead	Reservoir	Red		21,292	21,034	20,776	20,518	20,260	20,000
Wichita System				*34,884*	*33,968*	*33,052*	*32,136*	*31,220*	*30,300*
Kemp Municipal	Reservoir	Red		6,097	5,753	5,410	5,066	4,722	4,379
Total Supplies				**40,981**	**39,721**	**38,462**	**37,202**	**35,942**	**34,679**

Supplies Less Current Customer Demand				**2,246**	**2,128**	**-180**	**-1,467**	**-2,744**	**-4,203**
Supplies Less Current and Future Customer Demand				**1,657**	**1,540**	**-802**	**-2,114**	**-3,407**	**-4,875**



APPENDIX B

REGIONAL WATER PLANNING GROUP B

WATER USER GROUP SUMMARIES

Water User Group:	Archer City - Archer						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population	1,848	2,022	2,200	2,345	2,390	2,307	2,223
Water Demand (ac-ft/yr)	232	333	343	356	357	341	328
Current Supply - contract w/ Wichita Falls (ac-ft/yr)	288	288	288	288	288	288	288
Current Supply - Archer City Lake (ac-ft/yr)	278	278	278	278	278	278	278
Supply - Demand (ac-ft/yr)	333	232	222	209	208	224	237
Required Safe Supply (ac-ft/yr)	278	400	412	427	428	409	394
Safe Supply Shortage (ac-ft/yr)	287	166	154	138	137	156	172
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	County-Other - Archer						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	497	544	591	632	643	621	597
Water Demand (ac-ft/yr)	69	513	465	499	525	480	474
Current Supply - contracts w/ Wichita Falls (ac-ft/yr)	224	224	224	224	224	224	224
Current supply - Lake Megargel	0	0	0	0	0	0	0
Other Aquifer - Red Basin	103	103	103	103	103	103	103
Other Aquifer - Brazos Basin	24	20	8	7	7	7	7
Other Aquifer - Trinity Basin	4	4	4	4	4	4	4
Supply - Demand (ac-ft/yr)	286	-162	-126	-161	-187	-142	-136
Required Safe Supply (ac-ft/yr)	83	616	558	599	630	576	569
Safe Supply Shortage (ac-ft/yr)	268	**-269**	**-223**	**-265**	**-296**	**-242**	**-235**
Recommended 2011 Plan Strategy	Conservation, Purchase water from local provider						

Water User Group:	**Holliday - Archer**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	1,632	1,786	1,943	2,071	2,110	2,038	1,963
Water Demand (ac-ft/yr)	245	249	258	266	267	255	246
Current Supply - Wichita Falls (ac-ft/yr)	294	299	310	319	320	306	295
Supply - Demand (ac-ft/yr)	49	50	52	53	53	51	49
Required Safe Supply (ac-ft/yr)	294	299	310	319	320	306	295
Safe Supply Shortage (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	**Lakeside City - Archer**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	984	1,077	1,172	1,249	1,272	1,228	1,183
Water Demand (ac-ft/yr)	125	166	163	173	169	161	155
Current Supply - Wichita Falls (ac-ft/yr)	196	196	196	196	196	196	196
Supply - Demand (ac-ft/yr)	71	30	33	23	27	35	41
Required Safe Supply (ac-ft/yr)	150	199	196	208	203	193	186
Safe Supply Shortage (ac-ft/yr)	46	**-3**	0	**-12**	**-7**	3	10
Recommended 2011 Plan Strategy	Conservation, Increase supply from Wichita Falls						

Water User Group:	Wichita Valley WSC - Archer						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	2,736	2,994	3,258	3,472	3,538	3,416	3,291
Water Demand (ac-ft/yr)	184	347	356	351	343	329	316
Current Supply- Wichita Falls System (ac-ft/yr)	818	801	791	792	786	763	741
Current Supply- Sales from Archer City (ac-ft/yr)	40	40	40	40	40	40	40
Supply - Demand (ac-ft/yr)	674	494	475	481	483	474	465
Required Safe Supply (ac-ft/yr)	221	416	427	421	412	395	379
Safe Supply Shortage (ac-ft/yr)	638	424	403	411	414	408	402
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Windthorst WSC - Archer						
		2010	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	1,157	1,266	1,378	1,468	1,496	1,444	1,392
Water Demand (ac-ft/yr)	351	198	205	203	202	199	196
Current Supply - raw water - Wichita Falls (ac-ft/yr)	353	355	359	363	366	367	369
Supply - Demand (ac-ft/yr)	2	157	154	160	164	168	173
Required Safe Supply (ac-ft/yr)	421	238	246	244	242	239	235
Safe Supply Shortage (ac-ft/yr)	-69	118	113	119	123	128	134
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	**Irrigation - Archer**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	1,971	3,500	3,400	3,300	3,200	3,100	3,100
Current Supply- Lake Kemp (ac-ft/yr)	3,642	2,193	2,050	1,908	1,768	1,629	1,510
Current Supply- Run-of-river	7	7	7	7	7	7	7
Supply - Demand (ac-ft/yr)	1,678	-1,301	-1,344	-1,386	-1,426	-1,465	-1,584
Recommended 2011 Plan Strategy	Increase water conservation elevation at Lake Kemp, Chloride control						

Water User Group:	**Livestock - Archer**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	2,579	2,711	2,711	2,711	2,711	2,711	2,711
Current Supply stock ponds (ac-ft/yr)	2,320	2,439	2,439	2,439	2,439	2,439	2,439
Current Supply - Other Aquifer - Trinity	182	228	228	228	228	228	228
Current Supply - Other Aquifer - Red	24	30	30	30	30	30	30
Current Supply - Other Aquifer - Brazos	11	14	14	14	14	14	14
Supply - Demand (ac-ft/yr)	-42	0	0	0	0	0	0
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	**Mining - Archer**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	1	0	0	0	0	0	0
Current Supply - Groundwater (ac-ft/yr)	0	0	0	0	0	0	0
Supply - Demand (ac-ft/yr)	-1	0	0	0	0	0	0
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	**Steam Electric Power - Archer**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	0	0	0	0	0	0	0
Current Supply - Lake Kemp (ac-ft/yr)	0	0	0	0	0	0	0
Supply - Demand (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	County-Other - Baylor						
	2000	2010	2020	2030	2040	2050	2060
Population (number of persons)	1,185	1,173	1,166	1,156	1,147	1,141	1,133
Water Demand (ac-ft/yr)	215	277	264	229	226	222	221
Current Supply - Seymour Aquifer - Brazos (ac-ft/yr)	340	340	340	340	340	340	340
Current Supply - Seymour Aquifer - Red (ac-ft/yr)	80	80	80	80	80	80	80
Supply - Demand (ac-ft/yr)	205	143	156	191	194	198	199
Required Safe Supply (ac-ft/yr)	258	332	317	275	271	266	265
Safe Supply Shortage (ac-ft/yr)	82	8	23	65	69	74	75
Recommended 2011 Plan Strategy	Connection to Miller's Creek Reservoir (NCTMWA)						

Water User Group:	Irrigation - Baylor						
	2000	2010	2020	2030	2040	2050	2060
Population (number of persons)							
Water Demand (ac-ft/yr)	736	685	666	646	626	607	607
Current Supply - Run-of-river	17	17	17	17	17	17	17
Current Supply - Seymour Aquifer (Brazos) (ac-ft/yr)	1,837	1,837	1,837	1,837	1,837	1,837	1,837
Current Supply - Seymour Aquifer (Red) (ac-ft/yr)	375	375	375	375	375	375	375
Supply - Demand (ac-ft/yr)	1,493	1,544	1,563	1,583	1,603	1,622	1,622
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Livestock - Baylor						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	999	953	953	953	953	953	953
Current Supply Stock ponds (ac-ft/yr)	899	899	899	899	899	899	899
Current Supply - Seymour Aquifer - Basin	55	55	55	55	55	55	55
Current Supply - Seymour Aquifer - Red	55	55	55	55	55	55	55
Supply - Demand (ac-ft/yr)	10	56	56	56	56	56	56
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Mining - Baylor						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	39	21	10	5	0	0	0
Current Supply - Seymour Aquifer (ac-ft/yr)	47	47	47	47	47	47	47
Supply - Demand (ac-ft/yr)	8	26	37	42	47	47	47
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	**Seymour - Baylor**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	2,908	2,692	2,569	2,378	2,206	2,089	1,933
Water Demand (ac-ft/yr)	554	611	548	504	460	432	387
Current Supply - Seymour Aquifer (ac-ft/yr)	747	747	747	747	747	747	747
Supply - Demand (ac-ft/yr)	193	136	199	243	287	315	360
Required Safe Supply (ac-ft/yr)	665	733	658	605	552	518	464
Safe Supply Shortage (ac-ft/yr)	82	14	89	142	195	229	283
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	**Byers - Clay**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	517	534	550	546	524	491	459
Water Demand (ac-ft/yr)	69	83	81	78	73	64	64
Current Supply - Sales from Dean Dale WSC (ac-ft/yr)		45	45	45	45	45	45
Current Supply - Seymour Aquifer (ac-ft/yr)	91	65	65	65	65	65	65
Supply - Demand (ac-ft/yr)	22	27	29	32	37	46	46
Required Safe Supply (ac-ft/yr)	83	100	97	94	88	77	77
Safe Supply Shortage (ac-ft/yr)	8	**10**	**13**	**16**	**22**	**33**	**33**
Recommended 2011 Plan Strategy	Conservation						

Water User Group:	**County-Other - Clay**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	4,142	4,282	4,402	4,377	4,194	3,938	3,680
Water Demand (ac-ft/yr)	585	892	872	855	772	610	535
Current Supply - Contracts w/ Wichita Falls (ac-ft/yr)	420	420	420	420	420	420	420
Current Supply - Seymour Aquifer (ac-ft/yr)	55	55	55	55	55	55	55
Current Supply - Other Aquifer - Red (ac-ft/yr)	300	300	300	300	300	300	300
Current Supply - Other Aquifer - Trinity (ac-ft/yr)	72	72	72	72	72	72	72
Supply - Demand (ac-ft/yr)	262	**-45**	**-25**	**-8**	**75**	**237**	**312**
Required Safe Supply (ac-ft/yr)	702	1,070	1,046	1,026	926	732	642
Safe Supply Shortage (ac-ft/yr)	73	**-223**	**-199**	**-179**	**-79**	**115**	**205**
Recommended 2011 Plan Strategy	Conservation, Purchase treated water from local provider, Nitrate removal treatment for Charlie WSC						

Water User Group:	**Dean Dale WSC - Clay**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	2,081	2,151	2,212	2,199	2,108	1,978	1,849
Water Demand (ac-ft/yr)	217	230	224	218	206	199	192
Current Supply - Contracts w/ Wichita Falls (ac-ft/yr)	300	247	241	235	226	218	208
Current Supply - Seymour Aquifer (ac-ft/yr)	107	107	107	107	107	107	107
Supply - Demand (ac-ft/yr)	190	124	124	124	127	126	123
Required Safe Supply (ac-ft/yr)	260	276	269	262	247	239	230
Safe Supply Shortage (ac-ft/yr)	147	78	79	80	86	86	85
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	**Henrietta - Clay**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	
Population (number of persons)	3,264	3,374	3,470	3,448	3,306	3,103	2,900
Water Demand (ac-ft/yr)	526	720	701	677	638	592	553
Current Supply - Run-of-river (ac-ft/yr)	912	912	912	912	912	912	912
Supply - Demand (ac-ft/yr)	386	192	211	235	274	320	359
Required Safe Supply (ac-ft/yr)	631	864	841	812	766	710	664
Safe Supply Shortage (ac-ft/yr)	281	48	71	100	147	202	249
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	**Irrigation - Clay**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	
Population							
Water Demand (ac-ft/yr)	1,993	3,900	3,800	3,700	3,600	3,500	3,500
Current Supply - Lake Kemp (ac-ft/yr)	924	585	503	425	350	281	260
Current supply - Run-of-river	2,429	2,429	2,429	2,429	2,429	2,429	2,429
Current Supply - Seymour Aquifer (ac-ft/yr)	287	287	287	287	287	287	287
Current Supply - Other Aquifer (ac-ft/yr)	250	250	250	250	250	250	250
Supply - Demand (ac-ft/yr)	1,897	**-349**	**-331**	**-309**	**-284**	**-253**	**-274**
Recommended 2011 Plan Strategy	Increase water conservation elevation at Lake Kemp, Chloride control						

Water User Group:	**Livestock - Clay**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	
Population							
Water Demand (ac-ft/yr)	1,936	2,191	2,191	2,191	2,191	2,191	2,191
Current Supply Stock Ponds (ac-ft/yr)	1,742	1,982	1,982	1,982	1,982	1,982	1,982
Current Supply Other Aquifer - Red (ac-ft/yr)	175	175	175	175	175	175	175
Current Supply Other Aquifer - Trinity (ac-ft/yr)	25	25	25	25	25	25	25
Current Supply Seymour Aquifer (ac-ft/yr)	20	20	20	20	20	20	20
Supply - Demand (ac-ft/yr)	26	11	11	11	11	11	11
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Mining - Clay						
	2000	2010	2020	2030	2040	2050	
Population							
Water Demand (ac-ft/yr)	310	222	198	184	180	180	180
Current Supply Red Run-of-River	1	1	1	1	1	1	1
Current Supply Other Aquifer	6	6	6	6	6	6	6
Current Supply Seymour Aquifer (ac-ft/yr)	502	502	502	502	502	502	502
Supply - Demand (ac-ft/yr)	199	287	311	325	329	329	329
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Petrolia - Clay						
	2000	2010	2020	2030	2040	2050	
Population (number of persons)	782	808	831	826	792	743	695
Water Demand (ac-ft/yr)	93	95	92	90	84	73	73
Current Supply - Lake Petrolia (ac-ft/yr)	67	67	67	67	67	67	67
Current Supply - Seymour Aquifer (ac-ft/yr)	70	70	70	70	70	70	70
Supply - Demand (ac-ft/yr)	44	42	45	47	53	64	64
Required Safe Supply (ac-ft/yr)	112	114	110	108	101	88	88
Safe Supply Shortage (ac-ft/yr)	25	23	27	29	36	49	49
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	**Windthorst WSC - Clay**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	
Population (number of persons)	220	227	234	232	223	209	195
Water Demand (ac-ft/yr)	67	36	35	32	30	29	27
Current Supply - Sales Wichita Falls (ac-ft/yr)	67	65	61	57	54	53	51
Supply - Demand (ac-ft/yr)	0	29	26	25	24	24	24
Required Safe Supply (ac-ft/yr)	80	43	42	38	36	35	32
Safe Supply Shortage (ac-ft/yr)	-13	22	19	19	18	18	19
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	County-Other - Cottle						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	406	399	398	385	370	357	350
Water Demand (ac-ft/yr)	198	79	76	76	73	71	69
Current Supply Other Aquifer (ac-ft/yr)	200	200	200	200	200	200	200
Supply - Demand (ac-ft/yr)	2	121	124	124	127	129	131
Required Safe Supply (ac-ft/yr)	238	95	91	91	88	85	83
Safe Supply Shortage (ac-ft/yr)	-38	105	109	109	112	115	117
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Irrigation - Cottle						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	
Population							
Water Demand (ac-ft/yr)	4,201	4,301	4,172	4,047	3,925	3,808	3,808
Current Supply Blaine Aquifer (ac-ft/yr)	4,525	4,525	4,525	4,525	4,525	4,525	4,525
Current Supply Run of River (ac-ft/yr)	13	13	13	13	13	13	13
Supply - Demand (ac-ft/yr)	337	237	366	491	613	730	730
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Livestock - Cottle						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population							
Water Demand (ac-ft/yr)	499	387	387	387	387	387	387
Current Supply Blaine Aquifer (ac-ft/yr)	47	47	47	47	47	47	47
Current Supply Stock Ponds (ac-ft/yr)	449	449	449	449	449	449	449
Supply - Demand (ac-ft/yr)	-3	109	109	109	109	109	109
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Mining - Cottle						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	
Population							
Water Demand (ac-ft/yr)	23	25	27	28	30	30	30
Current Supply Blaine Aquifer (ac-ft/yr)	23	25	27	28	30	30	30
Supply - Demand (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Paducah - Cottle						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	
Population	1,498	1,458	1,455	1,384	1,304	1,233	1,193
Water Demand (ac-ft/yr)	247	316	300	277	256	239	232
Current Supply - Blaine Aquifer (ac-ft/yr)	532	532	532	532	532	532	532
Supply - Demand (ac-ft/yr)	285	216	232	255	276	293	300
Required Safe Supply (ac-ft/yr)	296	379	360	332	307	287	278
Safe Supply Shortage (ac-ft/yr)	236	153	172	200	225	246	254
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	County-Other - Foard						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	481	477	485	463	426	402	367
Water Demand (ac-ft/yr)	103	116	114	110	102	97	89
Current Supply Greenbelt Reservoir (ac-ft/yr)	68	68	68	68	68	68	68
Current Supply Seymour Aquifer (ac-ft/yr)	113	113	113	113	113	113	113
Supply - Demand (ac-ft/yr)	78	65	67	71	79	84	92
Required Safe Supply (ac-ft/yr)	124	139	137	132	122	116	107
Safe Supply Shortage (ac-ft/yr)	57	42	44	49	59	65	74
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Crowell - Foard						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	1,141	1,137	1,145	1,121	1,081	1,055	1,017
Water Demand (ac-ft/yr)	251	277	264	252	241	233	224
Current Supply Greenbelt Reservoir (ac-ft/yr)	301	332	317	302	289	280	269
Supply - Demand (ac-ft/yr)	50	55	53	50	48	47	45
Required Safe Supply (ac-ft/yr)	301	332	317	302	289	280	269
Safe Supply Shortage (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Irrigation - Foard						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	3,889	4,829	4,684	4,543	4,407	4,275	4,275
Current Supply Seymour Aquifer (ac-ft/yr)	5,232	5,232	5,232	5,232	5,232	5,232	5,232
Current Supply Blaine Aquifer (ac-ft/yr)	23	23	23	23	23	23	23
Supply - Demand (ac-ft/yr)	1,366	426	571	712	848	980	980
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Livestock - Foard						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	279	289	289	289	289	289	289
Current Supply Seymour Aquifer (ac-ft/yr)	28	38	38	38	38	38	38
Current Supply Stock Ponds (ac-ft/yr)	251	251	251	251	251	251	251
Supply - Demand (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	**Mining - Foard**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	22	24	24	25	26	27	27
Current Supply Seymour Aquifer (ac-ft/yr)	22	24	24	25	26	27	27
Supply - Demand (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Chillicothe - Hardeman						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	798	796	795	791	786	780	769
Water Demand (ac-ft/yr)	151	117	109	106	102	100	98
Current Supply Greenbelt Reservoir (ac-ft/yr)	76	61	55	53	51	50	49
Current Supply Seymour Aquifer (ac-ft/yr)	80	80	80	80	80	80	80
Supply - Demand (ac-ft/yr)	5	24	26	27	29	30	31
Required Safe Supply (ac-ft/yr)	181	140	131	127	122	120	118
Safe Supply Shortage (ac-ft/yr)	-26	0	4	6	9	10	11
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	County-Other - Hardeman						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	904	888	877	842	797	747	652
Water Demand (ac-ft/yr)	220	172	164	153	144	136	120
Current Supply Greenbelt Reservoir (ac-ft/yr)	210	210	210	210	210	210	210
Current Supply Seymour Aquifer (ac-ft/yr)	35	35	35	35	35	35	35
Supply - Demand (ac-ft/yr)	25	73	81	92	101	109	125
Required Safe Supply (ac-ft/yr)	264	206	197	184	173	163	144
Safe Supply Shortage (ac-ft/yr)	-19	39	48	61	72	82	101
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Irrigation - Hardeman						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	5,330	4,849	4,704	4,563	4,426	4,293	4,293
Current Supply Blaine Aquifer (ac-ft/yr)	5,200	5,200	5,200	5,200	5,200	5,200	5,200
Current Supply Run-of-river	148	148	148	148	148	148	148
Current Supply Seymour Aquifer (ac-ft/yr)	150	150	150	150	150	150	150
Supply - Demand (ac-ft/yr)	168	649	794	935	1,072	1,205	1,205
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Livestock - Hardeman						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	480	480	480	480	480	480	480
Current Supply Seymour Aquifer (ac-ft/yr)	198	198	198	198	198	198	198
Current Supply Stock Ponds (ac-ft/yr)	288	288	288	288	288	288	288
Supply - Demand (ac-ft/yr)	6	6	6	6	6	6	6
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Manufacturing - Hardeman						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	23	374	398	424	452	480	480
Current Supply Greenbelt Reservoir (ac-ft/yr)	28	449	478	509	542	576	576
Supply - Demand (ac-ft/yr)	5	75	80	85	90	96	96
Required Safe Supply (ac-ft/yr)	28	449	478	509	542	576	576
Safe Supply Shortage (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2011 Plan Strategy	None Identified						

Increase water conservation elevation at Lake Kemp, Chloride control

Water User Group:	Mining - Hardeman						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	111	3	3	2	2	2	2
Current Supply - Other Local Supply (ac-ft/yr)		7	7	7	7	7	7
Supply - Demand (ac-ft/yr)	-111	4	4	5	5	5	5
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Quanah - Hardeman						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	3,022	2,981	2,954	2,863	2,746	2,617	2,371
Water Demand (ac-ft/yr)	565	543	510	491	453	426	386
Current Supply Greenbelt Reservoir (ac-ft/yr)	678	652	612	589	544	511	463
Supply - Demand (ac-ft/yr)	113	109	102	98	91	85	77
Required Safe Supply (ac-ft/yr)	678	652	612	589	544	511	463
Safe Supply Shortage (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Steam Electric Power - Hardeman						
Increase water conservation elevation at La		**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	879	1,000	1,000	1,000	1,000	1,000	1,000
Current Supply Lake Pauline/ Groesbeck Crk (ac-ft/yr)	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Supply - Demand (ac-ft/yr)	321	200	200	200	200	200	200
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	County-Other - King						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	356	385	424	424	389	369	332
Water Demand (ac-ft/yr)	194	127	137	131	117	109	103
Current Supply Blaine Aquifer (ac-ft/yr)	190	190	190	190	190	190	190
Current Supply Other Aquifer - Dickens Co. (ac-ft/yr)	86	86	86	86	86	86	86
Current Supply Other Aquifer - Brazos (ac-ft/yr)	4	7	8	7	7	6	6
Supply - Demand (ac-ft/yr)	86	156	147	152	166	173	179
Required Safe Supply (ac-ft/yr)	233	152	164	157	140	131	124
Safe Supply Shortage (ac-ft/yr)	47	131	120	126	143	151	158
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Irrigation - King						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	
Population (number of persons)							
Water Demand (ac-ft/yr)	241	20	20	20	20	20	20
Current Supply Blaine Aquifer (ac-ft/yr)	241	241	241	241	241	241	241
Supply - Demand (ac-ft/yr)	0	221	221	221	221	221	221
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	**Livestock - King**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	
Population (number of persons)							
Water Demand (ac-ft/yr)	387	771	771	771	771	771	771
Current Supply Other Aquifer (ac-ft/yr)	28	28	28	28	28	28	28
Current Supply Blaine Aquifer (ac-ft/yr)	49	49	49	49	49	49	49
Current Supply Stock Ponds (ac-ft/yr)	348	694	694	694	694	694	694
Supply - Demand (ac-ft/yr)	38	0	0	0	0	0	0
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	**Bowie - Montague**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	5,219	5,305	5,389	5,423	5,436	5,440	5,449
Water Demand (ac-ft/yr)	824	1,027	987	966	952	941	943
Current Supply Amon Carter (ac-ft/yr)	1,270	1,302	1,229	1,160	1,092	1,027	961
Supply - Demand (ac-ft/yr)	446	275	242	194	140	86	18
Required Safe Supply (ac-ft/yr)	989	1,232	1,184	1,159	1,142	1,129	1,132
Safe Supply Shortage (ac-ft/yr)	281	70	44	1	-50	-103	-171
Recommended 2011 Plan Strategy	Conservation, Wastewater reuse						

Water User Group:	**County-Other - Montague**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	9,802	10,339	10,867	11,080	11,165	11,187	11,244
Water Demand (ac-ft/yr)	999	1,307	1,372	1,389	1,400	1,384	1,389
Current Supply Amon Carter (ac-ft/yr)	170	131	137	139	140	138	139
Current Supply Trinity Aquifer (ac-ft/yr)	200	200	200	200	200	200	200
Current Supply Lake Nocona (ac-ft/yr)	40	52	55	56	56	55	56
Current Supply Other Aquifer (ac-ft/yr)	700	700	700	700	700	700	700
Supply - Demand (ac-ft/yr)	111	**-224**	**-280**	**-295**	**-304**	**-290**	**-295**
Required Safe Supply (ac-ft/yr)	1,199	1,568	1,646	1,667	1,680	1,661	1,667
Safe Supply Shortage (ac-ft/yr)	-89	**-485**	**-554**	**-572**	**-584**	**-567**	**-572**
Recommended 2011 Plan Strategy	Purchase water from local provider						

Water User Group:	Irrigation - Montague						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	60	297	297	297	297	297	297
Current Supply Trinity Aquifer - Trinity (ac-ft/yr)	179	179	179	179	179	179	179
Current Supply Trinity Aquifer - Red (ac-ft/yr)	5	5	5	5	5	5	5
Current Supply Other Aquifer - Trinity (ac-ft/yr)	60	60	60	60	60	60	60
Current Supply Lk Nocona (ac-ft/yr)	100	100	100	100	100	100	100
Current Supply Red Run-of-River Wtr Rt 5605 (ac-ft/yr)	108	108	108	108	108	108	108
Supply - Demand (ac-ft/yr)	392	155	155	155	155	155	155
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Livestock - Montague						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	1,501	1,850	1,850	1,850	1,850	1,850	1,850
Current Supply Trinity Aquifer - Trinity (ac-ft/yr)	79	79	79	79	79	79	79
Current Supply Other Aquifer - Red (ac-ft/yr)	106	106	106	106	106	106	106
Current Supply Stock ponds (ac-ft/yr)	1,351	1,665	1,665	1,665	1,665	1,665	1,665
Supply - Demand (ac-ft/yr)	35	0	0	0	0	0	0
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Manufacturing - Montague						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	6	9	12	15	19	24	24
Current Supply Lk Nocona (ac-ft/yr)	7	11	14	18	23	29	29
Supply - Demand (ac-ft/yr)	1	2	2	3	4	5	5
Required Safe Supply (ac-ft/yr)	7	11	14	18	23	29	29
Safe Supply Shortage (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Mining - Montague						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)		505	481	473	477	490	490
Current Supply Other Aquifer (ac-ft/yr)	248	248	248	248	248	248	248
Current Supply Trinity Aquifer (ac-ft/yr)	80	80	80	80	80	80	80
Current supply Amon Carter	60	0	0	0	0	0	0
Current Supply Run-of-River (ac-ft/yr)	0	0	0	0	0	0	0
Supply - Demand (ac-ft/yr)	388	**-177**	**-153**	**-145**	**-149**	**-162**	**-162**
Recommended 2011 Plan Strategy	Purchase water from local provider, develop new groundwater						

Water User Group:	Nocona - Montague						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	3,198	3,321	3,442	3,491	3,510	3,515	3,528
Water Demand (ac-ft/yr)	484	693	681	671	664	657	660
Current Supply Lake Nocona (ac-ft/yr)	1,113	1,097	1,091	1,086	1,081	1,076	1,075
Supply - Demand (ac-ft/yr)	629	404	410	415	417	419	415
Required Safe Supply (ac-ft/yr)	581	832	817	805	797	788	792
Safe Supply Shortage (ac-ft/yr)	532	265	274	281	284	287	283
Recommended 2011 Plan Strategy	None identified						

Water User Group:	Saint Jo - Montague						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	898	898	898	898	898	898	898
Water Demand (ac-ft/yr)	210	99	101	98	97	96	96
Current Supply Trinity Aquifer (ac-ft/yr)	211	211	211	211	211	211	211
Supply - Demand (ac-ft/yr)	1	112	110	113	114	115	115
Required Safe Supply (ac-ft/yr)	252	119	121	118	116	115	115
Safe Supply Shortage (ac-ft/yr)	-41	92	90	93	95	96	96
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Burkburnett - Wichita						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	10,927	11,465	11,949	12,269	12,436	12,553	12,647
Water Demand (ac-ft/yr)	1,273	1,843	1,820	1,816	1,809	1,806	1,819
Current Supply Seymour Aquifer (ac-ft/yr)	916	916	916	916	916	916	916
Current Supply Wichita System (ac-ft/yr)	1,437	1,433	1,411	1,390	1,364	1,343	1,343
Supply - Demand (ac-ft/yr)	1,080	506	507	490	471	453	440
Required Safe Supply (ac-ft/yr)	1,528	2,212	2,184	2,179	2,171	2,167	2,183
Safe Supply Shortage (ac-ft/yr)	826	138	143	127	109	92	76
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	County-Other - Wichita						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	3,056	2,639	2,264	2,015	1,885	1,793	1,721
Water Demand (ac-ft/yr)	318	224	228	226	224	223	223
Current Supply Wichita System (ac-ft/yr)	301	300	294	292	289	288	287
Current Supply Seymour Aquifer (ac-ft/yr)	380	380	380	380	380	380	380
Supply - Demand (ac-ft/yr)	363	456	446	446	445	445	444
Required Safe Supply (ac-ft/yr)	382	269	274	271	269	268	268
Safe Supply Shortage (ac-ft/yr)	300	411	400	400	400	400	399
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	**Electra - Wichita**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	3,168	3,206	3,240	3,263	3,275	3,283	3,290
Water Demand (ac-ft/yr)	337	575	550	539	531	526	527
Current Supply Lk Electra (ac-ft/yr)	200	0	0	0	0	0	0
Current Supply Sales from Iowa Park (Wichita System) (ac-ft/yr)	0	810	810	810	810	810	810
Current Supply Seymour Aquifer (ac-ft/yr)	234	0	0	0	0	0	0
Supply - Demand (ac-ft/yr)	97	**235**	**260**	**271**	**279**	**284**	**283**
Required Safe Supply (ac-ft/yr)	404	690	660	647	637	631	632
Safe Supply Shortage (ac-ft/yr)	30	**120**	**150**	**163**	**173**	**179**	**178**
Recommended 2011 Plan Strategy	Conservation						

Water User Group:	**Iowa Park - Wichita**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	6,431	6,678	6,900	7,047	7,124	7,178	7,221
Water Demand (ac-ft/yr)	1,232	1,210	1,184	1,176	1,169	1,163	1,170
Current Supply Lk Iowa Park/Lake Gordon (ac-ft/yr)	0	0	0	0	0	0	0
Current Supply NF Buffalo Crk (ac-ft/yr)	-110	0	0	0	0	0	0
Current Supply Wichita System (ac-ft/yr)	1,121	1,224	1,216	1,209	1,200	1,193	1,193
Supply - Demand (ac-ft/yr)	-221	14	32	33	31	30	23
Required Safe Supply (ac-ft/yr)	1,478	1,452	1,421	1,411	1,403	1,396	1,404
Safe Supply Shortage (ac-ft/yr)	-468	-229	-204	-202	-202	-202	-211
Recommended 2011 Plan Strategy	Conservation, Increase purchases from Wichita Falls						

Water User Group:	**Irrigation - Wichita**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population							
Water Demand (ac-ft/yr)	19,556	59,000	58,000	57,000	56,000	55,000	55,000
Current Supply Lk Kemp (ac-ft/yr)	36,140	35,743	33,787	31,824	29,855	27,880	25,838
Current Supply WR #5023(ROR) (ac-ft/yr)	0	0	0	0	0	0	0
Current Supply Run-of-river (ac-ft/yr)	351	351	351	351	351	351	351
Current Supply Seymour Aquifer (ac-ft/yr)	1,431	1,431	1,431	1,431	1,431	1,431	1,431
Current Supply Other Aquifer (ac-ft/yr)	179	179	179	179	179	179	179
Supply - Demand (ac-ft/yr)	18,545	**-21,296**	**-22,252**	**-23,215**	**-24,184**	**-25,159**	**-27,201**
Recommended 2011 Plan Strategy	Increase elevation at Lake Kemp, Wichita River diversion, Convert canal laterals into pipe, Chloride Control Project, Land Stewardship						

Water User Group:	**Livestock - Wichita**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	740	740	740	740	740	740	740
Current Supply Seymour Aquifer (ac-ft/yr)	74	74	74	74	74	74	74
Current Supply Stock Ponds (ac-ft/yr)	404	704	704	704	704	704	704
Current Supply Santa Rosa Lake (ac-ft/yr)	300	300	300	300	300	300	300
Supply - Demand (ac-ft/yr)	38	338	338	338	338	338	338
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	**Manufacturing - Wichita**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	2,292	2,315	2,441	2,558	2,702	2,814	2,814
Current Supply Wichita System (sales from Wichita Falls) (ac-ft/yr)	1,719	1,736	1,831	1,919	2,027	2,111	2,111
Current Supply Wichita System (sales from Burkburnett) (ac-ft/yr)	413	417	439	460	486	507	507
Current Supply Wichita System (sales from Iowa Park) (ac-ft/yr)	138	139	146	153	162	169	169
Current Supply Seymour Aquifer (ac-ft/yr)	129	129	129	129	129	129	129
Supply - Demand (ac-ft/yr)	106	106	104	103	102	102	102
Required Safe Supply (ac-ft/yr)	2,750	2,778	2,928	3,069	3,242	3,377	3,377
Safe Supply Shortage (ac-ft/yr)	-352	-357	-383	-409	-439	-462	-462
Recommended 2011 Plan Strategy	Increase supplies from Wichita Falls						

Water User Group:	**Mining - Wichita**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	29	86	78	70	46	39	39
Current Supply Seymour Aquifer (ac-ft/yr)	29	86	78	70	46	39	39
Current Supply Run-of-river (ac-ft/yr)	0	0	0	0	0	0	0
Supply - Demand (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Dean Dale WSC - Wichita						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	1,121	1,248	1,362	1,438	1,478	1,506	1,528
Water Demand (ac-ft/yr)	117	134	138	142	145	151	158
Current Supply - Wichita System (ac-ft/yr)	162	170	176	182	191	199	209
Supply - Demand (ac-ft/yr)	45	36	38	40	46	48	51
Required Safe Supply (ac-ft/yr)	140	161	166	170	174	181	190
Safe Supply Shortage (ac-ft/yr)	22	9	10	12	17	18	19
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Steam Electric Power - Wichita						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	262	360	360	360	360	360	360
Current Supply Wichita System (ac-ft/yr)	262	360	360	360	360	360	360
Supply - Demand (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Wichita Falls - Wichita						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	104,197	109,663	114,576	117,825	119,525	120,710	121,668
Water Demand (ac-ft/yr)	21,943	23,049	22,015	22,810	22,743	22,700	22,874
Current Supply Wichita System (ac-ft/yr)	24,843	23,808	22,792	21,781	20,759	19,774	18,866
Current Supply Lk Kemp (ac-ft/yr)	0	6,097	5,753	5,410	5,066	4,722	4,379
Supply - Demand (ac-ft/yr)	2,900	6,856	6,530	4,381	3,082	1,796	371
Required Safe Supply (ac-ft/yr)	26,332	27,659	26,418	27,372	27,292	27,240	27,449
Safe Supply Shortage (ac-ft/yr)	-1,489	2,246	2,127	-181	-1,467	-2,745	-4,204
Recommended 2011 Plan Strategy	Conservation, Lake Ringgold Alternate Strategy - Wastewater reuse						

Water User Group:	Wichita Valley WSC - Wichita						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	2,764	3,159	3,514	3,749	3,872	3,958	4,027
Water Demand (ac-ft/yr)	186	366	385	378	375	381	386
Current Supply - Wichita System (ac-ft/yr)	218	236	246	244	250	274	296
Current Supply - Sales from Iowa Park (ac-ft/yr)	673	673	673	673	673	673	673
Supply - Demand (ac-ft/yr)	705	542	533	539	548	566	582
Required Safe Supply (ac-ft/yr)	223	439	462	454	450	457	463
Safe Supply Shortage (ac-ft/yr)	668	469	456	463	473	489	505
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	County-Other - Wilbarger						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	3,016	3,140	3,273	3,287	3,221	3,064	2,883
Water Demand (ac-ft/yr)	510	479	486	481	466	440	426
Current Supply Seymour Aquifer Sales from Vernon	280	280	280	280	280	280	280
Current Supply Seymour Aquifer	275	275	275	275	275	275	275
Current Supply Wichita System sales from Electra (ac-ft/yr)	30	30	30	30	30	30	30
Current Supply Greenbelt Reservoir (ac-ft/yr)	6	6	6	6	6	6	6
Current Supply Red Run-of-River (ac-ft/yr)	115	115	115	115	115	115	115
Supply - Demand (ac-ft/yr)	196	227	220	225	240	266	280
Required Safe Supply (ac-ft/yr)	612	575	583	577	559	528	511
Safe Supply Shortage (ac-ft/yr)	94	131	123	129	147	178	195
Recommended 2011 Plan Strategy	None identified						

Water User Group:	Irrigation - Wilbarger						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	28,527	18,499	17,944	17,406	16,884	16,377	16,377
Current Supply Seymour Aq (ac-ft/yr)	26,055	25,291	25,291	25,291	25,291	25,291	25,291
Current Supply Run-of-river (ac-ft/yr)	825	825	825	825	825	825	825
Supply - Demand (ac-ft/yr)	-1,647	7,617	8,172	8,710	9,232	9,739	9,739
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	**Livestock - Wilbarger**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	1,066	1,797	1,797	1,797	1,797	1,797	1,797
Current Supply Seymour Aquifer (ac-ft/yr)	180	180	180	180	180	180	180
Current Supply Stock Ponds (ac-ft/yr)	959	1,617	1,617	1,617	1,617	1,617	1,617
Supply - Demand (ac-ft/yr)	73	0	0	0	0	0	0
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	**Manufacturing - Wilbarger**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	841	849	904	971	1,087	1,206	1,206
Current Supply Seymour Aquifer Sales from Vernon	841	1,019	1,085	1,165	1,304	1,447	1,447
Supply - Demand (ac-ft/yr)	0	170	181	194	217	241	241
Required Safe Supply (ac-ft/yr)	1,009	1,019	1,085	1,165	1,304	1,447	1,447
Safe Supply Shortage (ac-ft/yr)	-168	**0**	**0**	**0**	**0**	**0**	**0**
Recommended 2011 Plan Strategy	None identified						

Water User Group:	Mining - Wilbarger						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	28	23	24	24	24	24	24
Current Supply Seymour Aquifer (ac-ft/yr)	10	10	10	10	10	10	10
Current Supply Beaver Creek (ac-ft/yr)	30	30	30	30	30	30	30
Supply - Demand (ac-ft/yr)	12	17	16	16	16	16	16
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Steam Electric Power - Wilbarger						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	8,700	12,000	16,000	20,000	20,000	20,000	20,000
Current Supply Lk Kemp (ac-ft/yr)		12,929	12,200	11,471	10,742	10,013	9,285
Supply - Demand (ac-ft/yr)	-8,700	929	-3,800	**-8,529**	**-9,258**	**-9,987**	**-10,715**
Recommended 2011 Plan Strategy	Increase water elevation at Lake Kemp, Chlordie Control Project						

Water User Group:	**Vernon - Wilbarger**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	11,660	12,139	12,655	12,706	12,451	11,844	11,144
Water Demand (ac-ft/yr)	2,795	2,671	2,659	2,627	2,519	2,383	2,229
Current Supply Seymour Aquifer (ac-ft/yr)	2,859	3,445	3,379	3,299	3,160	3,017	3,017
Supply - Demand (ac-ft/yr)	64	774	720	672	641	634	788
Required Safe Supply (ac-ft/yr)	3,354	3,205	3,191	3,152	3,023	2,860	2,675
Safe Supply Shortage (ac-ft/yr)	-495	**240**	**188**	**146**	**137**	**157**	**342**
Recommended 2011 Plan Strategy	Conservation						

Water User Group:	Olney - Young						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	3,396	3,429	3,504	3,509	3,469	3,418	3,386
Water Demand (ac-ft/yr)	609	707	685	667	647	631	625
Current Supply Wichita System (ac-ft/yr)	283	298	298	298	298	298	298
Current Supply Lk Olney/Cooper (ac-ft/yr)	608	645	645	645	645	645	645
Supply - Demand (ac-ft/yr)	282	236	258	276	296	312	318
Required Safe Supply (ac-ft/yr)	731	848	822	800	776	757	750
Safe Supply Shortage (ac-ft/yr)	160	95	121	143	167	186	193
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	County-Other - Young						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	558	562	576	579	572	562	556
Water Demand (ac-ft/yr)	127	83	83	83	83	83	83
Current Supply Lk Olney/Cooper (ac-ft/yr)	152	100	100	100	100	100	100
Supply - Demand (ac-ft/yr)	25	17	17	17	17	17	17
Required Safe Supply (ac-ft/yr)	152	100	100	100	100	100	100
Safe Supply Shortage (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Livestock - Young						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	0	320	321	321	321	321	321
Current Supply Stock ponds (ac-ft/yr)	0	321	321	321	321	321	321
Supply - Demand (ac-ft/yr)	0	1	0	0	0	0	0
Recommended 2011 Plan Strategy	None Identified						

Water User Group:	Irrigation - Young County						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	0	15	15	15	15	15	15
Current Supply Lk Olney/Cooper (ac-ft/yr)	0	15	15	15	15	15	15
Supply - Demand (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2011 Plan Strategy	None Identified						

APPENDIX C

REGIONAL WATER PLANNING GROUP B

DATA BASE 12 TABLES

Region B Water User Group Population Projections

WUG Name	County	Basin	P2010	P2020	P2030	P2040	P2050	P2060
ARCHER CITY	ARCHER	RED	2,022	2,200	2,345	2,390	2,307	2,223
COUNTY-OTHER	ARCHER	BRAZOS	84	92	98	100	96	93
COUNTY-OTHER	ARCHER	RED	340	368	394	401	388	372
COUNTY-OTHER	ARCHER	TRINITY	120	131	140	142	137	132
HOLLIDAY	ARCHER	RED	1,786	1,943	2,071	2,110	2,038	1,963
LAKESIDE CITY	ARCHER	RED	1,077	1,172	1,249	1,272	1,228	1,183
WICHITA VALLEY WSC	ARCHER	RED	2,994	3,258	3,472	3,538	3,416	3,291
WINDTHORST WSC	ARCHER	RED	1,266	1,378	1,468	1,496	1,444	1,392
COUNTY-OTHER	BAYLOR	BRAZOS	851	846	839	832	827	821
COUNTY-OTHER	BAYLOR	RED	322	320	317	315	314	312
SEYMOUR	BAYLOR	BRAZOS	2,692	2,569	2,378	2,206	2,089	1,933
BYERS	CLAY	RED	534	550	546	524	491	459
COUNTY-OTHER	CLAY	RED	3,820	3,927	3,905	3,741	3,513	3,283
COUNTY-OTHER	CLAY	TRINITY	462	475	472	453	425	397
DEAN DALE WSC	CLAY	RED	2,151	2,212	2,199	2,108	1,978	1,849
HENRIETTA	CLAY	RED	3,374	3,470	3,448	3,306	3,103	2,900
PETROLIA	CLAY	RED	808	831	826	792	743	695
WINDTHORST WSC	CLAY	RED	227	234	232	223	209	195
COUNTY-OTHER	COTTLE	RED	399	398	385	370	357	350
PADUCAH	COTTLE	RED	1,458	1,455	1,384	1,304	1,233	1,193
COUNTY-OTHER	FOARD	RED	477	485	463	426	402	367
CROWELL	FOARD	RED	1,137	1,145	1,121	1,081	1,055	1,017
CHILLICOTHE	HARDEMAN	RED	796	795	791	786	780	769
COUNTY-OTHER	HARDEMAN	RED	888	877	842	797	747	652
QUANAH	HARDEMAN	RED	2,981	2,954	2,863	2,746	2,617	2,371
COUNTY-OTHER	KING	BRAZOS	22	24	24	22	21	19
COUNTY-OTHER	KING	RED	363	400	400	367	348	313
BOWIE	MONTAGUE	TRINITY	5,305	5,389	5,423	5,436	5,440	5,449
COUNTY-OTHER	MONTAGUE	RED	3,491	3,669	3,741	3,770	3,777	3,796
COUNTY-OTHER	MONTAGUE	TRINITY	6,848	7,198	7,339	7,395	7,410	7,448
NOCONA	MONTAGUE	RED	3,321	3,442	3,491	3,510	3,515	3,528
SAINT JO	MONTAGUE	TRINITY	898	898	898	898	898	898
BURKBURNETT	WICHITA	RED	11,465	11,949	12,269	12,436	12,553	12,647

Region B Water User Group Population Projections

WUG Name	County	Basin	P2010	P2020	P2030	P2040	P2050	P2060
COUNTY-OTHER	WICHITA	RED	2,639	2,264	2,015	1,885	1,793	1,721
DEAN DALE WSC	WICHITA	RED	1,248	1,362	1,438	1,478	1,506	1,528
ELECTRA	WICHITA	RED	3,206	3,240	3,263	3,275	3,283	3,290
IOWA PARK	WICHITA	RED	6,678	6,900	7,047	7,124	7,178	7,221
WICHITA FALLS	WICHITA	RED	109,663	114,576	117,825	119,525	120,710	121,668
WICHITA VALLEY WSC	WICHITA	RED	3,159	3,514	3,749	3,872	3,958	4,027
COUNTY-OTHER	WILBARGER	RED	3,140	3,273	3,287	3,221	3,064	2,883
VERNON	WILBARGER	RED	12,139	12,655	12,706	12,451	11,844	11,144
COUNTY-OTHER	YOUNG	BRAZOS	557	570	570	564	556	550
COUNTY-OTHER	YOUNG	TRINITY	5	6	9	8	6	6
OLNEY	YOUNG	BRAZOS	3,429	3,504	3,509	3,469	3,418	3,386

Region B Water User Group Demand
(Ac-ft per Year)

WUG Name	County	Basin	CNWD2010	CNWD2020	CNWD2030	CNWD2040	CNWD2050	CNWD2060
ARCHER CITY	ARCHER	RED	333	343	356	357	341	328
COUNTY-OTHER	ARCHER	BRAZOS	79	72	77	82	74	74
COUNTY-OTHER	ARCHER	RED	321	290	311	327	300	295
COUNTY-OTHER	ARCHER	TRINITY	113	103	111	116	106	105
HOLLIDAY	ARCHER	RED	249	258	266	267	255	246
IRRIGATION	ARCHER	RED	3,500	3,400	3,300	3,200	3,100	3,100
LAKESIDE CITY	ARCHER	RED	166	163	173	169	161	155
LIVESTOCK	ARCHER	BRAZOS	136	136	136	136	136	136
LIVESTOCK	ARCHER	RED	2,277	2,277	2,277	2,277	2,277	2,277
LIVESTOCK	ARCHER	TRINITY	298	298	298	298	298	298
WICHITA VALLEY WSC	ARCHER	RED	347	356	351	343	329	316
WINDTHORST WSC	ARCHER	RED	198	205	203	202	199	196
COUNTY-OTHER	BAYLOR	BRAZOS	201	192	166	164	161	160
COUNTY-OTHER	BAYLOR	RED	76	72	63	62	61	61
IRRIGATION	BAYLOR	BRAZOS	487	473	459	445	431	431
IRRIGATION	BAYLOR	RED	198	193	187	181	176	176
LIVESTOCK	BAYLOR	BRAZOS	353	353	353	353	353	353
LIVESTOCK	BAYLOR	RED	600	600	600	600	600	600
MINING	BAYLOR	BRAZOS	21	10	5	0	0	0
SEYMOUR	BAYLOR	BRAZOS	611	548	504	460	432	387
BYERS	CLAY	RED	83	81	78	73	64	64
COUNTY-OTHER	CLAY	RED	796	778	763	689	544	477
COUNTY-OTHER	CLAY	TRINITY	96	94	92	83	66	58
DEAN DALE WSC	CLAY	RED	230	224	218	206	199	192
HENRIETTA	CLAY	RED	720	701	677	638	592	553
IRRIGATION	CLAY	RED	3,900	3,800	3,700	3,600	3,500	3,500
LIVESTOCK	CLAY	RED	1,972	1,972	1,972	1,972	1,972	1,972
LIVESTOCK	CLAY	TRINITY	219	219	219	219	219	219
MINING	CLAY	RED	219	195	180	176	176	176
MINING	CLAY	TRINITY	3	3	4	4	4	4
PETROLIA	CLAY	RED	95	92	90	84	73	73
WINDTHORST WSC	CLAY	RED	36	35	32	30	29	27
COUNTY-OTHER	COTTLE	RED	79	76	76	73	71	69
IRRIGATION	COTTLE	RED	4,301	4,172	4,047	3,925	3,808	3,808

Region B Water User Group Demand
(Ac-ft per Year)

WUG Name	County	Basin	CNWD2010	CNWD2020	CNWD2030	CNWD2040	CNWD2050	CNWD2060
LIVESTOCK	COTTLE	RED	387	387	387	387	387	387
MINING	COTTLE	RED	25	27	28	30	30	30
PADUCAH	COTTLE	RED	316	300	277	256	239	232
COUNTY-OTHER	FOARD	RED	116	114	110	102	97	89
CROWELL	FOARD	RED	277	264	252	241	233	224
IRRIGATION	FOARD	RED	4,829	4,684	4,543	4,407	4,275	4,275
LIVESTOCK	FOARD	RED	289	289	289	289	289	289
MINING	FOARD	RED	24	24	25	26	27	27
CHILLICOTHE	HARDEMAN	RED	117	109	106	102	100	98
COUNTY-OTHER	HARDEMAN	RED	172	164	153	144	136	120
IRRIGATION	HARDEMAN	RED	4,849	4,704	4,563	4,426	4,293	4,293
LIVESTOCK	HARDEMAN	RED	480	480	480	480	480	480
MANUFACTURING	HARDEMAN	RED	374	398	424	452	480	480
MINING	HARDEMAN	RED	3	3	2	2	2	2
QUANAH	HARDEMAN	RED	543	510	491	453	426	386
STEAM ELECTRIC POWER	HARDEMAN	RED	1,000	1,000	1,000	1,000	1,000	1,000
COUNTY-OTHER	KING	BRAZOS	7	8	7	7	6	6
COUNTY-OTHER	KING	RED	120	129	124	110	103	97
IRRIGATION	KING	RED	20	20	20	20	20	20
LIVESTOCK	KING	BRAZOS	285	285	285	285	285	285
LIVESTOCK	KING	RED	486	486	486	486	486	486
BOWIE	MONTAGUE	TRINITY	1,027	987	966	952	941	943
COUNTY-OTHER	MONTAGUE	RED	441	463	469	473	467	469
COUNTY-OTHER	MONTAGUE	TRINITY	866	909	920	927	917	920
IRRIGATION	MONTAGUE	RED	59	59	59	59	59	59
IRRIGATION	MONTAGUE	TRINITY	238	238	238	238	238	238
LIVESTOCK	MONTAGUE	RED	1,054	1,054	1,054	1,054	1,054	1,054
LIVESTOCK	MONTAGUE	TRINITY	796	796	796	796	796	796
MANUFACTURING	MONTAGUE	RED	9	12	15	19	24	24
MINING	MONTAGUE	RED	491	467	459	463	476	476
MINING	MONTAGUE	TRINITY	14	14	14	14	14	14
NOCONA	MONTAGUE	RED	693	681	671	664	657	660
SAINT JO	MONTAGUE	TRINITY	99	101	98	97	96	96
BURKBURNETT	WICHITA	RED	1,843	1,820	1,816	1,809	1,806	1,819

Region B Water User Group Demand
(Ac-ft per Year)

WUG Name	County	Basin	CNWD2010	CNWD2020	CNWD2030	CNWD2040	CNWD2050	CNWD2060
COUNTY-OTHER	WICHITA	RED	224	228	226	224	223	223
DEAN DALE WSC	WICHITA	RED	134	138	142	145	151	158
ELECTRA	WICHITA	RED	575	550	539	531	526	527
IOWA PARK	WICHITA	RED	1,210	1,184	1,176	1,169	1,163	1,170
IRRIGATION	WICHITA	RED	59,000	58,000	57,000	56,000	55,000	55,000
LIVESTOCK	WICHITA	RED	740	740	740	740	740	740
MANUFACTURING	WICHITA	RED	2,315	2,441	2,558	2,702	2,814	2,814
MINING	WICHITA	RED	86	78	70	46	39	39
STEAM ELECTRIC POWER	WICHITA	RED	360	360	360	360	360	360
WICHITA FALLS	WICHITA	RED	23,049	22,015	22,810	22,743	22,700	22,874
WICHITA VALLEY WSC	WICHITA	RED	366	385	378	375	381	386
COUNTY-OTHER	WILBARGER	RED	479	486	481	466	440	426
IRRIGATION	WILBARGER	RED	18,499	17,944	17,406	16,884	16,377	16,377
LIVESTOCK	WILBARGER	RED	1,797	1,797	1,797	1,797	1,797	1,797
MANUFACTURING	WILBARGER	RED	849	904	971	1,087	1,206	1,206
MINING	WILBARGER	RED	23	24	24	24	24	24
STEAM ELECTRIC POWER	WILBARGER	RED	12,000	16,000	20,000	20,000	20,000	20,000
VERNON	WILBARGER	RED	2,671	2,659	2,627	2,519	2,383	2,229
COUNTY-OTHER	YOUNG	BRAZOS	82	82	82	82	82	82
COUNTY-OTHER	YOUNG	TRINITY	1	1	1	1	1	1
IRRIGATION	YOUNG	BRAZOS	10	10	10	10	10	10
IRRIGATION	YOUNG	TRINITY	5	5	5	5	5	5
LIVESTOCK	YOUNG	BRAZOS	300	300	300	300	300	300
LIVESTOCK	YOUNG	TRINITY	20	20	20	20	20	20
OLNEY	YOUNG	BRAZOS	707	685	667	647	631	625

Region B Source Availability
(Ac-ft per Year)

Source Name	County	Basin	TA2010	TA2020	TA2030	TA2040	TA2050	TA2060
LIVESTOCK LOCAL SUPPLY	ARCHER	BRAZOS	122	122	122	122	122	122
LIVESTOCK LOCAL SUPPLY	ARCHER	RED	2,049	2,049	2,049	2,049	2,049	2,049
LIVESTOCK LOCAL SUPPLY	ARCHER	TRINITY	268	268	268	268	268	268
OTHER AQUIFER	ARCHER	BRAZOS	151	151	151	151	151	151
OTHER AQUIFER	ARCHER	RED	1,175	1,175	1,175	1,175	1,175	1,175
OTHER AQUIFER	ARCHER	TRINITY	175	175	175	175	175	175
RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	ARCHER	RED	7	7	7	7	7	7
RED RIVER RUN-OF-RIVER ARCHER CITY	ARCHER	RED	278	278	278	278	278	278
BRAZOS RIVER COMBINED RUN-OF-RIVER IRRIGATION	BAYLOR	BRAZOS	17	17	17	17	17	17
LIVESTOCK LOCAL SUPPLY	BAYLOR	BRAZOS	333	333	333	333	333	333
LIVESTOCK LOCAL SUPPLY	BAYLOR	RED	566	566	566	566	566	566
SEYMOUR AQUIFER	BAYLOR	BRAZOS	8,205	8,205	8,205	8,205	8,205	8,205
SEYMOUR AQUIFER	BAYLOR	RED	1,485	1,485	1,485	1,485	1,485	1,485
LITTLE WICHITA RIVER RUN-OF-RIVER	CLAY	RED	1,451	1,451	1,451	1,451	1,451	1,451
LIVESTOCK LOCAL SUPPLY	CLAY	RED	1,784	1,784	1,784	1,784	1,784	1,784
LIVESTOCK LOCAL SUPPLY	CLAY	TRINITY	198	198	198	198	198	198
OTHER AQUIFER	CLAY	RED	884	884	884	884	884	884
OTHER AQUIFER	CLAY	TRINITY	142	142	142	142	142	142
RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	CLAY	RED	2,429	2,429	2,429	2,429	2,429	2,429
RED RIVER RUN-OF-RIVER INDUSTRIAL	CLAY	RED	127	127	127	127	127	127
RED RIVER RUN-OF-RIVER PETROLIA	CLAY	RED	107	107	107	107	107	107
SEYMOUR AQUIFER	CLAY	RED	7,870	7,870	7,870	7,870	7,870	7,870
BLAINE AQUIFER	COTTLE	RED	27,100	27,100	27,100	27,100	27,100	27,100
LIVESTOCK LOCAL SUPPLY	COTTLE	RED	449	449	449	449	449	449
OTHER AQUIFER	COTTLE	RED	451	451	451	451	451	451
RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	COTTLE	RED	13	13	13	13	13	13
SEYMOUR AQUIFER	COTTLE	RED	0	0	0	0	0	0
BLAINE AQUIFER	FOARD	RED	15,390	15,390	15,390	15,390	15,390	15,390
LIVESTOCK LOCAL SUPPLY	FOARD	RED	251	251	251	251	251	251
SEYMOUR AQUIFER	FOARD	RED	12,130	12,130	12,130	12,130	12,130	12,130
BLAINE AQUIFER	HARDEMAN	RED	23,770	23,770	23,770	23,770	23,770	23,770
LIVESTOCK LOCAL SUPPLY	HARDEMAN	RED	288	288	288	288	288	288
OTHER LOCAL SUPPLY	HARDEMAN	RED	7	7	7	7	7	7
RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	HARDEMAN	RED	148	148	148	148	148	148
SEYMOUR AQUIFER	HARDEMAN	RED	15,390	15,390	15,390	15,390	15,390	15,390
BLAINE AQUIFER	KING	RED	17,590	17,590	17,590	17,590	17,590	17,590
LIVESTOCK LOCAL SUPPLY	KING	BRAZOS	257	257	257	257	257	257
LIVESTOCK LOCAL SUPPLY	KING	RED	437	437	437	437	437	437
OTHER AQUIFER	KING	BRAZOS	61	61	61	61	61	61
OTHER AQUIFER	KING	RED	167	167	167	167	167	167
LIVESTOCK LOCAL SUPPLY	MONTAGUE	RED	949	949	949	949	949	949
LIVESTOCK LOCAL SUPPLY	MONTAGUE	TRINITY	716	716	716	716	716	716
OTHER AQUIFER	MONTAGUE	RED	815	815	815	815	815	815
OTHER AQUIFER	MONTAGUE	TRINITY	603	603	603	603	603	603

Region B Source Availability
(Ac-ft per Year)

Source Name	County	Basin	TA2010	TA2020	TA2030	TA2040	TA2050	TA2060
RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	MONTAGUE	RED	108	108	108	108	108	108
TRINITY AQUIFER	MONTAGUE	RED	129	129	129	129	129	129
TRINITY AQUIFER	MONTAGUE	TRINITY	2,545	2,545	2,545	2,545	2,545	2,545
TRINITY RIVER COMBINED RUN-OF-RIVER IRRIGATION	MONTAGUE	TRINITY	0	0	0	0	0	0
AMON G. CARTER LAKE/RESERVOIR	RESERVOIR	TRINITY	1,450	1,400	1,350	1,300	1,250	1,200
ELECTRA CITY LAKE/RESERVOIR	RESERVOIR	RED	462	454	446	438	430	420
FARMERS CREEK/NOCONA LAKE/RESERVOIR	RESERVOIR	RED	1,260	1,260	1,260	1,260	1,260	1,260
KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	62,383	58,866	55,349	51,832	48,315	44,800
NORTH FORK BUFFALO CREEK LAKE/RESERVOIR	RESERVOIR	RED	690	680	670	660	650	640
OLNEY-COOPER LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	760	760	760	760	760	760
PAULINE/GROESBECK LAKE/RESERVOIR	RESERVOIR	RED	1,200	1,200	1,200	1,200	1,200	1,200
SANTA ROSA LAKE/RESERVOIR	RESERVOIR	RED	3,075	3,075	3,075	3,075	3,075	3,075
WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	34,884	33,968	33,052	32,136	31,220	30,300
LIVESTOCK LOCAL SUPPLY	WICHITA	RED	704	704	704	704	704	704
OTHER AQUIFER	WICHITA	RED	658	658	658	658	658	658
RED RIVER COMBINED RUN-OF-RIVER IOWA PARK/GORDON	WICHITA	RED	555	555	555	555	555	555
RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	WICHITA	RED	351	351	351	351	351	351
RED RIVER RUN-OF-RIVER WCWID #2	WICHITA	RED	8,850	8,850	8,850	8,850	8,850	8,850
SEYMOUR AQUIFER	WICHITA	RED	13,920	13,920	13,920	13,920	13,920	13,920
BEAVER CREEK RUN-OF-RIVER MINING	WILBARGER	RED	30	30	30	30	30	30
LIVESTOCK LOCAL SUPPLY	WILBARGER	RED	1,617	1,617	1,617	1,617	1,617	1,617
OTHER AQUIFER	WILBARGER	RED	11	11	11	11	11	11
RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	WILBARGER	RED	825	825	825	825	825	825
RED RIVER COMBINED RUN-OF-RIVER MUNICIPAL	WILBARGER	RED	115	115	115	115	115	115
SEYMOUR AQUIFER	WILBARGER	RED	40,000	40,000	40,000	40,000	40,000	40,000
LIVESTOCK LOCAL SUPPLY	YOUNG	BRAZOS	301	301	301	301	301	301
LIVESTOCK LOCAL SUPPLY	YOUNG	TRINITY	20	20	20	20	20	20

Region B Water User Group Supply
(Ac-ft per Year)

WUG Name	WUG County	WUG Basin	Source Name	Source County	Source Basin	WS2010	WS2020	WS2030	WS2040	WS2050	WS2060
ARCHER CITY	ARCHER	RED	RED RIVER RUN-OF-RIVER ARCHER CITY	ARCHER	RED	278	278	278	278	278	278
ARCHER CITY	ARCHER	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	288	288	288	288	288	288
COUNTY-OTHER	ARCHER	BRAZOS	OTHER AQUIFER	ARCHER	BRAZOS	20	8	7	7	7	7
COUNTY-OTHER	ARCHER	RED	OTHER AQUIFER	ARCHER	RED	103	103	103	103	103	103
COUNTY-OTHER	ARCHER	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	224	224	224	224	224	224
COUNTY-OTHER	ARCHER	TRINITY	OTHER AQUIFER	ARCHER	TRINITY	4	4	4	4	4	4
HOLLIDAY	ARCHER	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	299	310	319	320	306	295
IRRIGATION	ARCHER	RED	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	2,193	2,050	1,908	1,768	1,629	1,510
IRRIGATION	ARCHER	RED	RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	ARCHER	RED	7	7	7	7	7	7
LAKESIDE CITY	ARCHER	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	196	196	196	196	196	196
LIVESTOCK	ARCHER	BRAZOS	LIVESTOCK LOCAL SUPPLY	ARCHER	BRAZOS	122	122	122	122	122	122
LIVESTOCK	ARCHER	BRAZOS	OTHER AQUIFER	ARCHER	BRAZOS	14	14	14	14	14	14
LIVESTOCK	ARCHER	RED	LIVESTOCK LOCAL SUPPLY	ARCHER	RED	2,049	2,049	2,049	2,049	2,049	2,049
LIVESTOCK	ARCHER	RED	OTHER AQUIFER	ARCHER	RED	228	228	228	228	228	228
LIVESTOCK	ARCHER	TRINITY	LIVESTOCK LOCAL SUPPLY	ARCHER	TRINITY	268	268	268	268	268	268
LIVESTOCK	ARCHER	TRINITY	OTHER AQUIFER	ARCHER	TRINITY	30	30	30	30	30	30
WICHITA VALLEY WSC	ARCHER	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	841	831	832	826	803	781
WINDTHORST WSC	ARCHER	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	355	359	363	366	367	369
COUNTY-OTHER	BAYLOR	BRAZOS	SEYMOUR AQUIFER	BAYLOR	BRAZOS	340	340	340	340	340	340
COUNTY-OTHER	BAYLOR	RED	SEYMOUR AQUIFER	BAYLOR	RED	80	80	80	80	80	80
IRRIGATION	BAYLOR	BRAZOS	BRAZOS RIVER COMBINED RUN-OF-RIVER IRRIGATION	BAYLOR	BRAZOS	17	17	17	17	17	17
IRRIGATION	BAYLOR	BRAZOS	SEYMOUR AQUIFER	BAYLOR	BRAZOS	1,837	1,837	1,837	1,837	1,837	1,837
IRRIGATION	BAYLOR	RED	SEYMOUR AQUIFER	BAYLOR	RED	375	375	375	375	375	375
LIVESTOCK	BAYLOR	BRAZOS	LIVESTOCK LOCAL SUPPLY	BAYLOR	BRAZOS	333	333	333	333	333	333
LIVESTOCK	BAYLOR	BRAZOS	SEYMOUR AQUIFER	BAYLOR	BRAZOS	55	55	55	55	55	55
LIVESTOCK	BAYLOR	RED	LIVESTOCK LOCAL SUPPLY	BAYLOR	RED	566	566	566	566	566	566
LIVESTOCK	BAYLOR	RED	SEYMOUR AQUIFER	BAYLOR	RED	55	55	55	55	55	55
MINING	BAYLOR	BRAZOS	SEYMOUR AQUIFER	BAYLOR	BRAZOS	47	47	47	47	47	47
SEYMOUR	BAYLOR	BRAZOS	SEYMOUR AQUIFER	BAYLOR	BRAZOS	747	747	747	747	747	747
BYERS	CLAY	RED	SEYMOUR AQUIFER	CLAY	RED	65	65	65	65	65	65
BYERS	CLAY	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	45	45	45	45	45	45
COUNTY-OTHER	CLAY	RED	OTHER AQUIFER	CLAY	RED	300	300	300	300	300	300
COUNTY-OTHER	CLAY	RED	SEYMOUR AQUIFER	CLAY	RED	55	55	55	55	55	55
COUNTY-OTHER	CLAY	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	420	420	420	420	420	420
COUNTY-OTHER	CLAY	TRINITY	OTHER AQUIFER	CLAY	TRINITY	72	72	72	72	72	72
DEAN DALE WSC	CLAY	RED	SEYMOUR AQUIFER	CLAY	RED	107	107	107	107	107	107
DEAN DALE WSC	CLAY	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	247	241	235	226	218	208
HENRIETTA	CLAY	RED	LITTLE WICHITA RIVER RUN-OF-RIVER	CLAY	RED	912	912	912	912	912	912
IRRIGATION	CLAY	RED	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	585	503	425	350	281	260
IRRIGATION	CLAY	RED	OTHER AQUIFER	CLAY	RED	250	250	250	250	250	250
IRRIGATION	CLAY	RED	RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	CLAY	RED	2,429	2,429	2,429	2,429	2,429	2,429
IRRIGATION	CLAY	RED	SEYMOUR AQUIFER	CLAY	RED	287	287	287	287	287	287
LIVESTOCK	CLAY	RED	LIVESTOCK LOCAL SUPPLY	CLAY	RED	1,784	1,784	1,784	1,784	1,784	1,784
LIVESTOCK	CLAY	RED	OTHER AQUIFER	CLAY	RED	175	175	175	175	175	175
LIVESTOCK	CLAY	RED	SEYMOUR AQUIFER	CLAY	RED	20	20	20	20	20	20
LIVESTOCK	CLAY	TRINITY	LIVESTOCK LOCAL SUPPLY	CLAY	TRINITY	198	198	198	198	198	198
LIVESTOCK	CLAY	TRINITY	OTHER AQUIFER	CLAY	TRINITY	25	25	25	25	25	25
MINING	CLAY	RED	LITTLE WICHITA RIVER RUN-OF-RIVER	CLAY	RED	1	1	1	1	1	1
MINING	CLAY	RED	SEYMOUR AQUIFER	CLAY	RED	502	502	502	502	502	502
MINING	CLAY	TRINITY	OTHER AQUIFER	CLAY	TRINITY	6	6	6	6	6	6
PETROLIA	CLAY	RED	RED RIVER RUN-OF-RIVER PETROLIA	CLAY	RED	67	67	67	67	67	67
PETROLIA	CLAY	RED	SEYMOUR AQUIFER	CLAY	RED	70	70	70	70	70	70
WINDTHORST WSC	CLAY	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	65	61	57	54	53	51
COUNTY-OTHER	COTTLE	RED	OTHER AQUIFER	COTTLE	RED	200	200	200	200	200	200
IRRIGATION	COTTLE	RED	BLAINE AQUIFER	COTTLE	RED	4,525	4,525	4,525	4,525	4,525	4,525
IRRIGATION	COTTLE	RED	RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	COTTLE	RED	13	13	13	13	13	13

Region B Water User Group Supply
(Ac-ft per Year)

WUG Name	WUG County	WUG Basin	Source Name	Source County	Source Basin	WS2010	WS2020	WS2030	WS2040	WS2050	WS2060
LIVESTOCK	COTTLE	RED	BLAINE AQUIFER	COTTLE	RED	47	47	47	47	47	47
LIVESTOCK	COTTLE	RED	LIVESTOCK LOCAL SUPPLY	COTTLE	RED	449	449	449	449	449	449
LIVESTOCK	COTTLE	RED	SEYMOUR AQUIFER	COTTLE	RED	0	0	0	0	0	0
MINING	COTTLE	RED	BLAINE AQUIFER	COTTLE	RED	25	27	28	30	30	30
PADUCAH	COTTLE	RED	BLAINE AQUIFER	COTTLE	RED	532	532	532	532	532	532
COUNTY-OTHER	FOARD	RED	GREENBELT LAKE/RESERVOIR	RESERVOIR	RED	68	68	68	68	68	68
COUNTY-OTHER	FOARD	RED	SEYMOUR AQUIFER	FOARD	RED	113	113	113	113	113	113
CROWELL	FOARD	RED	GREENBELT LAKE/RESERVOIR	RESERVOIR	RED	332	317	302	289	280	269
IRRIGATION	FOARD	RED	BLAINE AQUIFER	FOARD	RED	23	23	23	23	23	23
IRRIGATION	FOARD	RED	SEYMOUR AQUIFER	FOARD	RED	5,232	5,232	5,232	5,232	5,232	5,232
LIVESTOCK	FOARD	RED	LIVESTOCK LOCAL SUPPLY	FOARD	RED	251	251	251	251	251	251
LIVESTOCK	FOARD	RED	SEYMOUR AQUIFER	FOARD	RED	38	38	38	38	38	38
MINING	FOARD	RED	SEYMOUR AQUIFER	FOARD	RED	24	24	25	26	27	27
CHILLICOTHE	HARDEMAN	RED	GREENBELT LAKE/RESERVOIR	RESERVOIR	RED	61	55	53	51	50	49
CHILLICOTHE	HARDEMAN	RED	SEYMOUR AQUIFER	HARDEMAN	RED	80	80	80	80	80	80
COUNTY-OTHER	HARDEMAN	RED	GREENBELT LAKE/RESERVOIR	RESERVOIR	RED	210	210	210	210	210	210
COUNTY-OTHER	HARDEMAN	RED	SEYMOUR AQUIFER	HARDEMAN	RED	35	35	35	35	35	35
IRRIGATION	HARDEMAN	RED	BLAINE AQUIFER	HARDEMAN	RED	5,200	5,200	5,200	5,200	5,200	5,200
IRRIGATION	HARDEMAN	RED	RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	HARDEMAN	RED	148	148	148	148	148	148
IRRIGATION	HARDEMAN	RED	SEYMOUR AQUIFER	HARDEMAN	RED	150	150	150	150	150	150
LIVESTOCK	HARDEMAN	RED	LIVESTOCK LOCAL SUPPLY	HARDEMAN	RED	288	288	288	288	288	288
LIVESTOCK	HARDEMAN	RED	SEYMOUR AQUIFER	HARDEMAN	RED	198	198	198	198	198	198
MANUFACTURING	HARDEMAN	RED	GREENBELT LAKE/RESERVOIR	RESERVOIR	RED	449	478	509	542	576	576
MINING	HARDEMAN	RED	OTHER LOCAL SUPPLY	HARDEMAN	RED	7	7	7	7	7	7
QUANAH	HARDEMAN	RED	GREENBELT LAKE/RESERVOIR	RESERVOIR	RED	652	612	589	544	511	463
STEAM ELECTRIC POWER	HARDEMAN	RED	PAULINE/GROESBECK LAKE/RESERVOIR	RESERVOIR	RED	1,200	1,200	1,200	1,200	1,200	1,200
COUNTY-OTHER	KING	BRAZOS	OTHER AQUIFER	KING	BRAZOS	7	8	7	7	6	6
COUNTY-OTHER	KING	RED	BLAINE AQUIFER	KING	RED	190	190	190	190	190	190
COUNTY-OTHER	KING	RED	OTHER AQUIFER	DICKENS	RED	86	86	86	86	86	86
IRRIGATION	KING	RED	BLAINE AQUIFER	KING	RED	241	241	241	241	241	241
LIVESTOCK	KING	BRAZOS	LIVESTOCK LOCAL SUPPLY	KING	BRAZOS	257	257	257	257	257	257
LIVESTOCK	KING	BRAZOS	OTHER AQUIFER	KING	BRAZOS	28	28	28	28	28	28
LIVESTOCK	KING	RED	BLAINE AQUIFER	KING	RED	49	49	49	49	49	49
LIVESTOCK	KING	RED	LIVESTOCK LOCAL SUPPLY	KING	RED	437	437	437	437	437	437
BOWIE	MONTAGUE	TRINITY	AMON G. CARTER LAKE/RESERVOIR	RESERVOIR	TRINITY	1,302	1,229	1,160	1,092	1,027	961
COUNTY-OTHER	MONTAGUE	RED	FARMERS CREEK/NOCONA LAKE/RESERVOIR	RESERVOIR	RED	52	55	56	56	55	56
COUNTY-OTHER	MONTAGUE	RED	OTHER AQUIFER	MONTAGUE	RED	300	300	300	300	300	300
COUNTY-OTHER	MONTAGUE	TRINITY	AMON G. CARTER LAKE/RESERVOIR	RESERVOIR	TRINITY	131	137	139	140	138	139
COUNTY-OTHER	MONTAGUE	TRINITY	OTHER AQUIFER	MONTAGUE	TRINITY	400	400	400	400	400	400
COUNTY-OTHER	MONTAGUE	TRINITY	TRINITY AQUIFER	MONTAGUE	TRINITY	200	200	200	200	200	200
IRRIGATION	MONTAGUE	RED	FARMERS CREEK/NOCONA LAKE/RESERVOIR	RESERVOIR	RED	100	100	100	100	100	100
IRRIGATION	MONTAGUE	RED	RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	MONTAGUE	RED	108	108	108	108	108	108
IRRIGATION	MONTAGUE	RED	TRINITY AQUIFER	MONTAGUE	TRINITY	5	5	5	5	5	5
IRRIGATION	MONTAGUE	TRINITY	OTHER AQUIFER	MONTAGUE	TRINITY	60	60	60	60	60	60
IRRIGATION	MONTAGUE	TRINITY	TRINITY AQUIFER	MONTAGUE	TRINITY	179	179	179	179	179	179
IRRIGATION	MONTAGUE	TRINITY	TRINITY RIVER COMBINED RUN-OF-RIVER IRRIGATION	MONTAGUE	TRINITY	0	0	0	0	0	0
LIVESTOCK	MONTAGUE	RED	LIVESTOCK LOCAL SUPPLY	MONTAGUE	RED	949	949	949	949	949	949
LIVESTOCK	MONTAGUE	RED	OTHER AQUIFER	MONTAGUE	RED	106	106	106	106	106	106
LIVESTOCK	MONTAGUE	TRINITY	LIVESTOCK LOCAL SUPPLY	MONTAGUE	TRINITY	716	716	716	716	716	716
LIVESTOCK	MONTAGUE	TRINITY	TRINITY AQUIFER	MONTAGUE	TRINITY	80	80	80	80	80	80
MANUFACTURING	MONTAGUE	RED	FARMERS CREEK/NOCONA LAKE/RESERVOIR	RESERVOIR	RED	11	14	18	23	29	29
MINING	MONTAGUE	RED	AMON G. CARTER LAKE/RESERVOIR	RESERVOIR	TRINITY	0	0	0	0	0	0
MINING	MONTAGUE	RED	OTHER AQUIFER	MONTAGUE	RED	248	248	248	248	248	248
MINING	MONTAGUE	RED	TRINITY AQUIFER	MONTAGUE	RED	80	80	80	80	80	80
MINING	MONTAGUE	TRINITY	AMON G. CARTER LAKE/RESERVOIR	RESERVOIR	TRINITY	0	0	0	0	0	0
NOCONA	MONTAGUE	RED	FARMERS CREEK/NOCONA LAKE/RESERVOIR	RESERVOIR	RED	1,097	1,091	1,086	1,081	1,076	1,075

Region B Water User Group Supply
(Ac-ft per Year)

WUG Name	WUG County	WUG Basin	Source Name	Source County	Source Basin	WS2010	WS2020	WS2030	WS2040	WS2050	WS2060
SAINT JO	MONTAGUE	TRINITY	TRINITY AQUIFER	MONTAGUE	TRINITY	211	211	211	211	211	211
BURKBURNETT	WICHITA	RED	SEYMOUR AQUIFER	WICHITA	RED	916	916	916	916	916	916
BURKBURNETT	WICHITA	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	1,433	1,411	1,390	1,364	1,343	1,343
COUNTY-OTHER	WICHITA	RED	SEYMOUR AQUIFER	WICHITA	RED	380	380	380	380	380	380
COUNTY-OTHER	WICHITA	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	300	294	292	289	288	287
DEAN DALE WSC	WICHITA	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	170	176	182	191	199	209
ELECTRA	WICHITA	RED	ELECTRA CITY LAKE/RESERVOIR	RESERVOIR	RED	0	0	0	0	0	0
ELECTRA	WICHITA	RED	SEYMOUR AQUIFER	WICHITA	RED	0	0	0	0	0	0
ELECTRA	WICHITA	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	810	810	810	810	810	810
IOWA PARK	WICHITA	RED	NORTH FORK BUFFALO CREEK LAKE/RESERVOIR	RESERVOIR	RED	0	0	0	0	0	0
IOWA PARK	WICHITA	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	1,224	1,216	1,209	1,200	1,193	1,193
IRRIGATION	WICHITA	RED	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	35,743	33,787	31,824	29,855	27,880	25,838
IRRIGATION	WICHITA	RED	OTHER AQUIFER	WICHITA	RED	179	179	179	179	179	179
IRRIGATION	WICHITA	RED	RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	WICHITA	RED	351	351	351	351	351	351
IRRIGATION	WICHITA	RED	RED RIVER RUN-OF-RIVER WCWID #2	WICHITA	RED	0	0	0	0	0	0
IRRIGATION	WICHITA	RED	SEYMOUR AQUIFER	WICHITA	RED	1,431	1,431	1,431	1,431	1,431	1,431
LIVESTOCK	WICHITA	RED	LIVESTOCK LOCAL SUPPLY	WICHITA	RED	704	704	704	704	704	704
LIVESTOCK	WICHITA	RED	SANTA ROSA LAKE/RESERVOIR	RESERVOIR	RED	300	300	300	300	300	300
LIVESTOCK	WICHITA	RED	SEYMOUR AQUIFER	WICHITA	RED	74	74	74	74	74	74
MANUFACTURING	WICHITA	RED	NORTH FORK BUFFALO CREEK LAKE/RESERVOIR	RESERVOIR	RED	0	0	0	0	0	0
MANUFACTURING	WICHITA	RED	SEYMOUR AQUIFER	WICHITA	RED	129	129	129	129	129	129
MANUFACTURING	WICHITA	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	2,292	2,416	2,532	2,675	2,787	2,787
MINING	WICHITA	RED	SEYMOUR AQUIFER	WICHITA	RED	86	78	70	46	39	39
STEAM ELECTRIC POWER	WICHITA	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	360	360	360	360	360	360
WICHITA FALLS	WICHITA	RED	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	6,097	5,753	5,410	5,066	4,722	4,379
WICHITA FALLS	WICHITA	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	23,808	22,792	21,781	20,759	19,774	18,866
WICHITA VALLEY WSC	WICHITA	RED	NORTH FORK BUFFALO CREEK LAKE/RESERVOIR	RESERVOIR	RED	0	0	0	0	0	0
WICHITA VALLEY WSC	WICHITA	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	909	919	917	923	947	969
COUNTY-OTHER	WILBARGER	RED	ELECTRA CITY LAKE/RESERVOIR	RESERVOIR	RED	30	30	30	30	30	30
COUNTY-OTHER	WILBARGER	RED	GREENBELT LAKE/RESERVOIR	RESERVOIR	RED	6	6	6	6	6	6
COUNTY-OTHER	WILBARGER	RED	RED RIVER COMBINED RUN-OF-RIVER MUNICIPAL	WILBARGER	RED	115	115	115	115	115	115
COUNTY-OTHER	WILBARGER	RED	SEYMOUR AQUIFER	WILBARGER	RED	555	555	555	555	555	555
IRRIGATION	WILBARGER	RED	RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	WILBARGER	RED	825	825	825	825	825	825
IRRIGATION	WILBARGER	RED	SEYMOUR AQUIFER	WILBARGER	RED	25,291	25,291	25,291	25,291	25,291	25,291
LIVESTOCK	WILBARGER	RED	LIVESTOCK LOCAL SUPPLY	WILBARGER	RED	1,617	1,617	1,617	1,617	1,617	1,617
LIVESTOCK	WILBARGER	RED	SEYMOUR AQUIFER	WILBARGER	RED	180	180	180	180	180	180
MANUFACTURING	WILBARGER	RED	SEYMOUR AQUIFER	WILBARGER	RED	1,019	1,085	1,165	1,304	1,447	1,447
MINING	WILBARGER	RED	BEAVER CREEK RUN-OF-RIVER MINING	WILBARGER	RED	30	30	30	30	30	30
MINING	WILBARGER	RED	SEYMOUR AQUIFER	WILBARGER	RED	10	10	10	10	10	10
STEAM ELECTRIC POWER	WILBARGER	RED	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	12,929	12,200	11,471	10,742	10,013	9,285
VERNON	WILBARGER	RED	SEYMOUR AQUIFER	WILBARGER	RED	3,445	3,379	3,299	3,160	3,017	3,017
COUNTY-OTHER	YOUNG	BRAZOS	OLNEY-COOPER LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	99	99	99	99	99	99
COUNTY-OTHER	YOUNG	TRINITY	OLNEY-COOPER LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	1	1	1	1	1	1
IRRIGATION	YOUNG	BRAZOS	OLNEY-COOPER LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	10	10	10	10	10	10
IRRIGATION	YOUNG	TRINITY	OLNEY-COOPER LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	5	5	5	5	5	5
LIVESTOCK	YOUNG	BRAZOS	LIVESTOCK LOCAL SUPPLY	YOUNG	BRAZOS	301	301	301	301	301	301
LIVESTOCK	YOUNG	TRINITY	LIVESTOCK LOCAL SUPPLY	YOUNG	TRINITY	20	20	20	20	20	20
OLNEY	YOUNG	BRAZOS	OLNEY-COOPER LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	645	645	645	645	645	645
OLNEY	YOUNG	BRAZOS	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	298	298	298	298	298	298

Region B Water User Group Needs
(Ac-ft per Year)

WUG Name	County	Basin	WNS2010	WNS2020	WNS2030	WNS2040	WNS2050	WNS2060
ARCHER CITY	ARCHER	RED	233	223	210	209	225	238
BOWIE	MONTAGUE	TRINITY	275	242	194	140	86	18
BURKBURNETT	WICHITA	RED	506	507	490	471	453	440
BYERS	CLAY	RED	27	29	32	37	46	46
CHILLICOTHE	HARDEMAN	RED	24	26	27	29	30	31
COUNTY-OTHER	ARCHER	BRAZOS	-59	-64	-70	-75	-67	-67
COUNTY-OTHER	ARCHER	RED	6	37	16	0	27	32
COUNTY-OTHER	ARCHER	TRINITY	-109	-99	-107	-112	-102	-101
COUNTY-OTHER	BAYLOR	BRAZOS	139	148	174	176	179	180
COUNTY-OTHER	BAYLOR	RED	4	8	17	18	19	19
COUNTY-OTHER	CLAY	RED	-21	-3	12	86	231	298
COUNTY-OTHER	CLAY	TRINITY	-24	-22	-20	-11	6	14
COUNTY-OTHER	COTTLE	RED	121	124	124	127	129	131
COUNTY-OTHER	FOARD	RED	65	67	71	79	84	92
COUNTY-OTHER	HARDEMAN	RED	73	81	92	101	109	125
COUNTY-OTHER	KING	BRAZOS	0	0	0	0	0	0
COUNTY-OTHER	KING	RED	156	147	152	166	173	179
COUNTY-OTHER	MONTAGUE	RED	-89	-108	-113	-117	-112	-113
COUNTY-OTHER	MONTAGUE	TRINITY	-135	-172	-181	-187	-179	-181
COUNTY-OTHER	WICHITA	RED	456	446	446	445	445	444
COUNTY-OTHER	WILBARGER	RED	227	220	225	240	266	280
COUNTY-OTHER	YOUNG	BRAZOS	17	17	17	17	17	17
COUNTY-OTHER	YOUNG	TRINITY	0	0	0	0	0	0
CROWELL	FOARD	RED	55	53	50	48	47	45
DEAN DALE WSC	CLAY	RED	124	124	124	127	126	123
DEAN DALE WSC	WICHITA	RED	36	38	40	46	48	51
ELECTRA	WICHITA	RED	235	260	271	279	284	283
HENRIETTA	CLAY	RED	192	211	235	274	320	359
HOLLIDAY	ARCHER	RED	50	52	53	53	51	49
IOWA PARK	WICHITA	RED	14	32	33	31	30	23
IRRIGATION	ARCHER	RED	-1,300	-1,343	-1,385	-1,425	-1,464	-1,583
IRRIGATION	BAYLOR	BRAZOS	1,367	1,381	1,395	1,409	1,423	1,423
IRRIGATION	BAYLOR	RED	177	182	188	194	199	199
IRRIGATION	CLAY	RED	-349	-331	-309	-284	-253	-274

Region B Water User Group Needs
(Ac-ft per Year)

WUG Name	County	Basin	WNS2010	WNS2020	WNS2030	WNS2040	WNS2050	WNS2060
IRRIGATION	COTTLE	RED	237	366	491	613	730	730
IRRIGATION	FOARD	RED	426	571	712	848	980	980
IRRIGATION	HARDEMAN	RED	649	794	935	1,072	1,205	1,205
IRRIGATION	KING	RED	221	221	221	221	221	221
IRRIGATION	MONTAGUE	RED	154	154	154	154	154	154
IRRIGATION	MONTAGUE	TRINITY	1	1	1	1	1	1
IRRIGATION	WICHITA	RED	-21,296	-22,252	-23,215	-24,184	-25,159	-27,201
IRRIGATION	WILBARGER	RED	7,617	8,172	8,710	9,232	9,739	9,739
IRRIGATION	YOUNG	BRAZOS	0	0	0	0	0	0
IRRIGATION	YOUNG	TRINITY	0	0	0	0	0	0
LAKESIDE CITY	ARCHER	RED	30	33	23	27	35	41
LIVESTOCK	ARCHER	BRAZOS	0	0	0	0	0	0
LIVESTOCK	ARCHER	RED	0	0	0	0	0	0
LIVESTOCK	ARCHER	TRINITY	0	0	0	0	0	0
LIVESTOCK	BAYLOR	BRAZOS	35	35	35	35	35	35
LIVESTOCK	BAYLOR	RED	21	21	21	21	21	21
LIVESTOCK	CLAY	RED	7	7	7	7	7	7
LIVESTOCK	CLAY	TRINITY	4	4	4	4	4	4
LIVESTOCK	COTTLE	RED	109	109	109	109	109	109
LIVESTOCK	FOARD	RED	0	0	0	0	0	0
LIVESTOCK	HARDEMAN	RED	6	6	6	6	6	6
LIVESTOCK	KING	BRAZOS	0	0	0	0	0	0
LIVESTOCK	KING	RED	0	0	0	0	0	0
LIVESTOCK	MONTAGUE	RED	1	1	1	1	1	1
LIVESTOCK	MONTAGUE	TRINITY	0	0	0	0	0	0
LIVESTOCK	WICHITA	RED	338	338	338	338	338	338
LIVESTOCK	WILBARGER	RED	0	0	0	0	0	0
LIVESTOCK	YOUNG	BRAZOS	1	1	1	1	1	1
LIVESTOCK	YOUNG	TRINITY	0	0	0	0	0	0
MANUFACTURING	HARDEMAN	RED	75	80	85	90	96	96
MANUFACTURING	MONTAGUE	RED	2	2	3	4	5	5
MANUFACTURING	WICHITA	RED	106	104	103	102	102	102
MANUFACTURING	WILBARGER	RED	170	181	194	217	241	241
MINING	BAYLOR	BRAZOS	26	37	42	47	47	47

Region B Water User Group Needs
(Ac-ft per Year)

WUG Name	County	Basin	WNS2010	WNS2020	WNS2030	WNS2040	WNS2050	WNS2060
MINING	CLAY	RED	284	308	323	327	327	327
MINING	CLAY	TRINITY	3	3	2	2	2	2
MINING	COTTLE	RED	0	0	0	0	0	0
MINING	FOARD	RED	0	0	0	0	0	0
MINING	HARDEMAN	RED	4	4	5	5	5	5
MINING	MONTAGUE	RED	-163	-139	-131	-135	-148	-148
MINING	MONTAGUE	TRINITY	-14	-14	-14	-14	-14	-14
MINING	WICHITA	RED	0	0	0	0	0	0
MINING	WILBARGER	RED	17	16	16	16	16	16
NOCONA	MONTAGUE	RED	404	410	415	417	419	415
OLNEY	YOUNG	BRAZOS	236	258	276	296	312	318
PADUCAH	COTTLE	RED	216	232	255	276	293	300
PETROLIA	CLAY	RED	42	45	47	53	64	64
QUANAH	HARDEMAN	RED	109	102	98	91	85	77
SAINT JO	MONTAGUE	TRINITY	112	110	113	114	115	115
SEYMOUR	BAYLOR	BRAZOS	136	199	243	287	315	360
STEAM ELECTRIC POWER	HARDEMAN	RED	200	200	200	200	200	200
STEAM ELECTRIC POWER	WICHITA	RED	0	0	0	0	0	0
STEAM ELECTRIC POWER	WILBARGER	RED	929	-3,800	-8,529	-9,258	-9,987	-10,715
VERNON	WILBARGER	RED	774	720	672	641	634	788
WICHITA FALLS	WICHITA	RED	6,856	6,530	4,381	3,082	1,796	371
WICHITA VALLEY WSC	ARCHER	RED	494	475	481	483	474	465
WICHITA VALLEY WSC	WICHITA	RED	543	534	539	548	566	583
WINDTHORST WSC	ARCHER	RED	157	154	160	164	168	173
WINDTHORST WSC	CLAY	RED	29	26	25	24	24	24

WUG Name	WUG County	WUG Basin	Project Name	Source Name	Source County	Source Basin	Selected	SS2010	SS2020	SS2030	SS2040	SS2050	SS2060
IRRIGATION	ARCHER	RED	INCREASE WATER CONSERVATION POOL AT LAKE KEMP	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	Recommended	0	1,344	1,386	1,426	1,465	1,584
COUNTY-OTHER	ARCHER	BRAZOS	MUNICIPAL CONSERVATION	CONSERVATION	ARCHER	BRAZOS	Recommended	1	2	2	3	3	3
COUNTY-OTHER	ARCHER	RED	MUNICIPAL CONSERVATION	CONSERVATION	ARCHER	RED	Recommended	4	7	9	9	10	11
LAKESIDE CITY	ARCHER	RED	MUNICIPAL CONSERVATION	CONSERVATION	ARCHER	RED	Recommended	3	9	10	11	11	11
COUNTY-OTHER	ARCHER	TRINITY	MUNICIPAL CONSERVATION	CONSERVATION	ARCHER	TRINITY	Recommended	2	2	3	4	4	4
COUNTY-OTHER	ARCHER	BRAZOS	PURCHASE WATER FROM LOCAL PROVIDER	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	Recommended	90	90	90	90	90	90
COUNTY-OTHER	ARCHER	RED	PURCHASE WATER FROM LOCAL PROVIDER	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	Recommended	72	72	72	72	72	72
COUNTY-OTHER	ARCHER	TRINITY	PURCHASE WATER FROM LOCAL PROVIDER	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	Recommended	134	134	134	134	134	134
LAKESIDE CITY	ARCHER	RED	PURCHASE WATER FROM LOCAL PROVIDER	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	Recommended	12	12	12	12	12	12
COUNTY-OTHER	BAYLOR	BRAZOS	EMERGENCY INTERCONNECT MILLERS CREEK RESERVOIR	MILLERS CREEK LAKE/RESERVOIR	RESERVOIR	BRAZOS	Recommended	250	250	250	250	250	250
IRRIGATION	CLAY	RED	INCREASE WATER CONSERVATION POOL AT LAKE KEMP	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	Recommended	0	331	309	284	253	274
COUNTY-OTHER	CLAY	RED	MUNICIPAL CONSERVATION	CONSERVATION	CLAY	RED	Recommended	14	38	40	40	37	35
COUNTY-OTHER	CLAY	TRINITY	MUNICIPAL CONSERVATION	CONSERVATION	CLAY	TRINITY	Recommended	2	4	5	5	4	4
COUNTY-OTHER	CLAY	RED	NITRATE REMOVAL PLANT	SEYMOUR AQUIFER	CLAY	RED	Recommended	10	10	10	10	10	10
COUNTY-OTHER	CLAY	RED	PURCHASE WATER FROM LOCAL PROVIDER	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	Recommended	112	112	112	112	112	112
COUNTY-OTHER	CLAY	TRINITY	PURCHASE WATER FROM LOCAL PROVIDER	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	Recommended	111	111	111	111	111	111
COUNTY-OTHER	MONTAGUE	RED	DEVELOP OTHER AQUIFER SUPPLIES	OTHER AQUIFER	MONTAGUE	RED	Recommended	160	160	160	160	160	160
COUNTY-OTHER	MONTAGUE	TRINITY	DEVELOP OTHER AQUIFER SUPPLIES	OTHER AQUIFER	MONTAGUE	TRINITY	Recommended	85	85	85	85	85	85
COUNTY-OTHER	MONTAGUE	RED	DEVELOP TRINITY AQUIFER SUPPLIES	TRINITY AQUIFER	MONTAGUE	RED	Recommended	68	68	68	68	68	68
MINING	MONTAGUE	RED	DEVELOP TRINITY AQUIFER SUPPLIES	TRINITY AQUIFER	MONTAGUE	RED	Considered	177	177	177	177	177	177
BOWIE	MONTAGUE	TRINITY	DEVELOP TRINITY AQUIFER SUPPLIES	TRINITY AQUIFER	MONTAGUE	TRINITY	Considered	171	171	171	171	171	171
COUNTY-OTHER	MONTAGUE	TRINITY	DEVELOP TRINITY AQUIFER SUPPLIES	TRINITY AQUIFER	MONTAGUE	TRINITY	Recommended	271	271	271	271	271	271
COUNTY-OTHER	MONTAGUE	RED	MUNICIPAL CONSERVATION	CONSERVATION	MONTAGUE	RED	Recommended	9	46	47	47	48	48
BOWIE	MONTAGUE	TRINITY	MUNICIPAL CONSERVATION	CONSERVATION	MONTAGUE	TRINITY	Recommended	8	34	34	61	69	72
COUNTY-OTHER	MONTAGUE	TRINITY	MUNICIPAL CONSERVATION	CONSERVATION	MONTAGUE	TRINITY	Recommended	9	32	33	33	33	33
COUNTY-OTHER	MONTAGUE	RED	PURCHASE WATER FROM LOCAL PROVIDER	AMON G. CARTER LAKE/RESERVOIR	RESERVOIR	TRINITY	Alternate	200	200	200	200	200	200
COUNTY-OTHER	MONTAGUE	TRINITY	PURCHASE WATER FROM LOCAL PROVIDER	AMON G. CARTER LAKE/RESERVOIR	RESERVOIR	TRINITY	Alternate	384	384	384	384	384	384
MINING	MONTAGUE	TRINITY	PURCHASE WATER FROM LOCAL PROVIDER	AMON G. CARTER LAKE/RESERVOIR	RESERVOIR	TRINITY	Recommended	14	14	14	14	14	14
COUNTY-OTHER	MONTAGUE	RED	PURCHASE WATER FROM LOCAL PROVIDER	FARMERS CREEK/NOCONA LAKE/RESERVOIR	RESERVOIR	RED	Alternate	384	384	384	384	384	384
MINING	MONTAGUE	RED	PURCHASE WATER FROM LOCAL PROVIDER	FARMERS CREEK/NOCONA LAKE/RESERVOIR	RESERVOIR	RED	Recommended	163	163	163	163	163	163
BOWIE	MONTAGUE	TRINITY	WASTEWATER REUSE	AMON G. CARTER LAKE/RESERVOIR	RESERVOIR	TRINITY	Recommended	0	0	0	171	171	171
WICHITA FALLS	WICHITA	RED	CONSTRUCT LAKE RINGGOLD	RINGGOLD LAKE/RESERVOIR	RESERVOIR	RED	Recommended	0	0	0	0	27,000	27,000
IRRIGATION	WICHITA	RED	ENCLOSE CANAL LATERALS IN PIPE	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	Recommended	13,034	13,034	13,034	13,034	13,034	13,034
IRRIGATION	WICHITA	RED	INCREASE WATER CONSERVATION POOL AT LAKE KEMP	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	Recommended	0	15,995	11,186	10,392	9,605	8,687
WICHITA FALLS	WICHITA	RED	INCREASE WATER CONSERVATION POOL AT LAKE KEMP	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	Recommended	0	3,364	3,366	3,358	3,350	3,340
IOWA PARK	WICHITA	RED	MUNICIPAL CONSERVATION	CONSERVATION	WICHITA	RED	Recommended	21	57	68	72	76	80
WICHITA FALLS	WICHITA	RED	MUNICIPAL CONSERVATION	CONSERVATION	WICHITA	RED	Recommended	124	533	548	556	562	1,367
MANUFACTURING	WICHITA	RED	PURCHASE WATER FROM LOCAL PROVIDER	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	Recommended	0	462	462	462	462	462
IOWA PARK	WICHITA	RED	PURCHASE WATER FROM LOCAL PROVIDER	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	Recommended	229	229	229	229	229	229
MANUFACTURING	WICHITA	RED	PURCHASE WATER FROM LOCAL PROVIDER	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	Recommended	462	0	0	0	0	0
WICHITA FALLS	WICHITA	RED	WASTEWATER REUSE	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	Alternate	0	0	0	11,000	11,000	11,000
IRRIGATION	WICHITA	RED	WICHITA RIVER DIVERSION	RED RIVER RUN-OF-RIVER WCWID #2	WICHITA	RED	Recommended	0	0	0	8,850	8,850	8,850

Region B Water User Group Potentially Feasible Water Managment Strategy Supply
(Ac-ft per Year)

WUG Name	WUG County	WUG Basin	Project Name	Source Name	Source County	Source Basin	Selected	SS2010	SS2020	SS2030	SS2040	SS2050	SS2060
STEAM ELECTRIC POWER	WILBARGER	RED	INCREASE WATER CONSERVATION POOL AT LAKE KEMP	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	Recommended	0	3,800	8,529	9,258	9,987	10,715
COUNTY-OTHER	WILBARGER	RED	NITRATE REMOVAL PLANT	SEYMOUR AQUIFER	WILBARGER	RED	Considered	109	109	109	109	109	109
COUNTY-OTHER	WILBARGER	RED	NITRATE REMOVAL PLANT	SEYMOUR AQUIFER	WILBARGER	RED	Recommended	40	40	40	40	40	40
COUNTY-OTHER	WILBARGER	RED	PURCHASE WATER FROM LOCAL PROVIDER	SEYMOUR AQUIFER	WILBARGER	RED	Considered	40	40	40	40	40	40
COUNTY-OTHER	WILBARGER	RED	PURCHASE WATER FROM LOCAL PROVIDER	SEYMOUR AQUIFER	WILBARGER	RED	Recommended	109	109	109	109	109	109

WUG Name	WUG County	WUG Basin	Project Name	Source Name	Capital Cost	AC 2010	AC 2020	AC 2030	AC 2040	AC 2050	AC 2060
COUNTY-OTHER	ARCHER	BRAZOS	MUNICIPAL CONSERVATION	CONSERVATION	$0	$0	$0	$0	$0	$0	$0
COUNTY-OTHER	ARCHER	RED	MUNICIPAL CONSERVATION	CONSERVATION	$0	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
LAKESIDE CITY	ARCHER	RED	MUNICIPAL CONSERVATION	CONSERVATION	$0	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000
COUNTY-OTHER	ARCHER	TRINITY	MUNICIPAL CONSERVATION	CONSERVATION	$0	$0	$0	$0	$0	$0	$0
COUNTY-OTHER	CLAY	RED	MUNICIPAL CONSERVATION	CONSERVATION	$0	$9,000	$9,000	$9,000	$9,000	$9,000	$9,000
COUNTY-OTHER	CLAY	TRINITY	MUNICIPAL CONSERVATION	CONSERVATION	$0	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000
COUNTY-OTHER	CLAY	RED	NITRATE REMOVAL PLANT	SEYMOUR AQUIFER	$200,500	$25,500	$25,500	$8,000	$8,000	$8,000	$8,000
COUNTY-OTHER	MONTAGUE	RED	DEVELOP OTHER AQUIFER SUPPLIES	OTHER AQUIFER	$625,616	$98,356	$98,356	$43,836	$43,836	$43,836	$43,836
COUNTY-OTHER	MONTAGUE	TRINITY	DEVELOP OTHER AQUIFER SUPPLIES	OTHER AQUIFER	$332,359	$52,252	$52,252	$23,288	$23,288	$23,288	$23,288
COUNTY-OTHER	MONTAGUE	RED	DEVELOP TRINITY AQUIFER SUPPLIES	TRINITY AQUIFER	$265,887	$41,801	$41,801	$18,630	$18,630	$18,630	$18,630
MINING	MONTAGUE	RED	DEVELOP TRINITY AQUIFER SUPPLIES	TRINITY AQUIFER	$654,000	$79,025	$79,025	$22,000	$22,000	$22,000	$22,000
BOWIE	MONTAGUE	TRINITY	DEVELOP TRINITY AQUIFER SUPPLIES	TRINITY AQUIFER	$1,650,000	$205,200	$205,200	$61,047	$61,047	$61,047	$61,047
COUNTY-OTHER	MONTAGUE	TRINITY	DEVELOP TRINITY AQUIFER SUPPLIES	TRINITY AQUIFER	$1,059,638	$166,591	$166,591	$74,247	$74,247	$74,247	$74,247
COUNTY-OTHER	MONTAGUE	RED	MUNICIPAL CONSERVATION	CONSERVATION	$0	$0	$0	$0	$0	$0	$0
BOWIE	MONTAGUE	TRINITY	MUNICIPAL CONSERVATION	CONSERVATION	$0	$436	$436	$436	$16,550	$16,550	$16,550
COUNTY-OTHER	MONTAGUE	TRINITY	MUNICIPAL CONSERVATION	CONSERVATION	$0	$0	$0	$0	$0	$0	$0
WICHITA FALLS	WICHITA	RED	CONSTRUCT LAKE RINGGOLD	RINGGOLD LAKE/RESERVOIR	$382,900,000	$0	$0	$0	$0	$38,014,500	$38,014,500
COUNTY-OTHER	BAYLOR	BRAZOS	EMERGENCY INTERCONNECT MILLERS CREEK RESERVOIR	MILLERS CREEK LAKE/RESERVOIR	$714,000	$313,000	$313,000	$250,000	$250,000	$250,000	$250,000
IRRIGATION	WICHITA	RED	ENCLOSE CANAL LATERALS IN PIPE	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	$7,658,469	$674,378	$674,378	$6,778	$6,778	$6,778	$6,778
IRRIGATION	WICHITA	RED	INCREASE WATER CONSERVATION POOL AT LAKE KEMP	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	$26,000	$0	$7,200	$5,000	$0	$0	$0
IRRIGATION	CLAY	RED	INCREASE WATER CONSERVATION POOL AT LAKE KEMP	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	$26,000	$0	$166	$155	$0	$0	$0
IRRIGATION	ARCHER	RED	INCREASE WATER CONSERVATION POOL AT LAKE KEMP	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	$26,000	$0	$600	$600	$0	$0	$0
STEAM ELECTRIC POWER	WILBARGER	RED	INCREASE WATER CONSERVATION POOL AT LAKE KEMP	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	$26,000	$0	$1,900	$4,065	$0	$0	$0
WICHITA FALLS	WICHITA	RED	INCREASE WATER CONSERVATION POOL AT LAKE KEMP	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	$26,000	$0	$1,634	$1,680	$0	$0	$0
COUNTY-OTHER	MONTAGUE	RED	PURCHASE WATER FROM LOCAL PROVIDER	AMON G. CARTER LAKE/RESERVOIR	$364,500	$700,650	$700,650	$668,700	$668,700	$668,700	$668,700
MINING	MONTAGUE	TRINITY	PURCHASE WATER FROM LOCAL PROVIDER	AMON G. CARTER LAKE/RESERVOIR	$0	$0	$0	$0	$0	$0	$0
COUNTY-OTHER	MONTAGUE	RED	PURCHASE WATER FROM LOCAL PROVIDER	FARMERS CREEK/NOCONA LAKE/RESERVOIR	$364,500	$460,800	$460,800	$439,700	$439,700	$439,700	$439,700
MINING	MONTAGUE	RED	PURCHASE WATER FROM LOCAL PROVIDER	FARMERS CREEK/NOCONA LAKE/RESERVOIR	$412,000	$241,074	$241,074	$205,143	$205,143	$205,143	$205,143
MANUFACTURING	WICHITA	RED	PURCHASE WATER FROM LOCAL PROVIDER	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	$0	$0	$489,230	$489,230	$489,230	$489,230	$489,230
COUNTY-OTHER	CLAY	RED	PURCHASE WATER FROM LOCAL PROVIDER	WICHITA LAKE/RESERVOIR SYSTEM	$182,000	$163,000	$163,000	$147,000	$147,000	$147,000	$147,000
COUNTY-OTHER	ARCHER	BRAZOS	PURCHASE WATER FROM LOCAL PROVIDER	WICHITA LAKE/RESERVOIR SYSTEM	$364,000	$518,000	$518,000	$483,000	$483,000	$483,000	$483,000
IOWA PARK	WICHITA	RED	PURCHASE WATER FROM LOCAL PROVIDER	WICHITA LAKE/RESERVOIR SYSTEM	$0	$242,500	$242,500	$242,500	$242,500	$242,500	$242,500
LAKESIDE CITY	ARCHER	RED	PURCHASE WATER FROM LOCAL PROVIDER	WICHITA LAKE/RESERVOIR SYSTEM	$0	$12,707	$12,707	$12,707	$12,707	$12,707	$12,707
MANUFACTURING	WICHITA	RED	PURCHASE WATER FROM LOCAL PROVIDER	WICHITA LAKE/RESERVOIR SYSTEM	$0	$489,230	$0	$0	$0	$0	$0
BOWIE	MONTAGUE	TRINITY	WASTEWATER REUSE	AMON G. CARTER LAKE/RESERVOIR	$1,206,500	$0	$0	$0	$162,500	$162,500	$57,000
WICHITA FALLS	WICHITA	RED	WASTEWATER REUSE	WICHITA LAKE/RESERVOIR SYSTEM	$57,100,000	$0	$0	$0	$8,467,000	$8,467,000	$3,488,000
IOWA PARK	WICHITA	RED	MUNICIPAL CONSERVATION	CONSERVATION	$0	$15,436	$21,550	$21,550	$21,550	$21,550	$21,550

Region B Potentially Feasible Water Management Strategy Cost

WUG Name	WUG County	WUG Basin	Project Name	Source Name	Capital Cost	AC 2010	AC 2020	AC 2030	AC 2040	AC 2050	AC 2060
WICHITA FALLS	WICHITA	RED	MUNICIPAL CONSERVATION	CONSERVATION	$0	$1,187	$1,187	$1,187	$1,187	$1,187	$108,711
IRRIGATION	WICHITA	RED	WICHITA RIVER DIVERSION	RED RIVER RUN-OF-RIVER WCWID #2	$5,380,000	$0	$0	$0	$644,000	$644,000	$175,000
COUNTY-OTHER	WILBARGER	RED	NITRATE REMOVAL PLANT	SEYMOUR AQUIFER	$412,000	$49,000	$49,000	$13,000	$13,000	$13,000	$13,000
COUNTY-OTHER	WILBARGER	RED	NITRATE REMOVAL PLANT	SEYMOUR AQUIFER	$446,500	$54,500	$54,500	$15,500	$15,500	$15,500	$15,500
COUNTY-OTHER	WILBARGER	RED	PURCHASE WATER FROM LOCAL PROVIDER	SEYMOUR AQUIFER	$1,658,700	$247,000	$247,000	$102,000	$102,000	$102,000	$102,000
COUNTY-OTHER	WILBARGER	RED	PURCHASE WATER FROM LOCAL PROVIDER	SEYMOUR AQUIFER	$848,000	$122,000	$122,000	$48,000	$48,000	$48,000	$48,000

Region B Wholesale Water Provider Demand
(Ac-ft per Year)

WWP Name	WUG Name	WUG County	WUG Basin	WD2010	WD2020	WD2030	WD2040	WD2050	WD2060
REGIONAL WATER PROVIDER-WICHITA BASIN CHLORIDE CONTROL PROJECT	IRRIGATION	WICHITA	RED	0	0	0	0	0	0
WICHITA FALLS CITY OF	ARCHER CITY	ARCHER	RED	336	336	336	336	336	336
WICHITA FALLS CITY OF	COUNTY-OTHER	ARCHER	RED	84	84	84	84	84	84
WICHITA FALLS CITY OF	BURKBURNETT	WICHITA	RED	1,850	1,850	1,850	1,850	1,850	1,850
WICHITA FALLS CITY OF	COUNTY-OTHER	CLAY	RED	292	286	280	271	263	253
WICHITA FALLS CITY OF	COUNTY-OTHER	WICHITA	RED	170	176	182	191	199	209
WICHITA FALLS CITY OF	COUNTY-OTHER	WICHITA	RED	140	140	140	140	140	140
WICHITA FALLS CITY OF	HOLLIDAY	ARCHER	RED	299	310	319	320	306	295
WICHITA FALLS CITY OF	IOWA PARK	WICHITA	RED	2,915	2,915	2,915	2,915	2,915	2,915
WICHITA FALLS CITY OF	LAKESIDE CITY	ARCHER	RED	196	196	196	196	196	196
WICHITA FALLS CITY OF	MANUFACTURING	WICHITA	RED	1,736	1,831	1,919	2,027	2,111	2,111
WICHITA FALLS CITY OF	OLNEY	YOUNG	BRAZOS	561	561	561	561	561	561
WICHITA FALLS CITY OF	COUNTY-OTHER	WICHITA	RED	120	114	112	109	108	107
WICHITA FALLS CITY OF	COUNTY-OTHER	CLAY	RED	420	420	420	420	420	420
WICHITA FALLS CITY OF	COUNTY-OTHER	ARCHER	RED	140	140	140	140	140	140
WICHITA FALLS CITY OF	STEAM ELECTRIC POWER	WICHITA	RED	360	360	360	360	360	360
WICHITA FALLS CITY OF	WICHITA FALLS	WICHITA	RED	27,659	26,418	27,372	27,292	27,240	27,449
WICHITA FALLS CITY OF	COUNTY-OTHER	WICHITA	RED	1,037	1,037	1,037	1,037	1,037	1,037
WICHITA FALLS CITY OF	COUNTY-OTHER	ARCHER	RED	420	420	420	420	420	420

Region B Wholesale Water Provider Supplies
(Ac-ft per Year)

WWP Name	WUG Name	WUG County	WUG Basin	Source Name	Source County	Source Basin	WPS2010	WPS2020	WPS2030	WPS2040	WPS2050	WPS2060
WICHITA FALLS CITY OF	ARCHER CITY	ARCHER	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	336	336	336	336	336	336
WICHITA FALLS CITY OF	COUNTY-OTHER	ARCHER	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	84	84	84	84	84	84
WICHITA FALLS CITY OF	BURKBURNETT	WICHITA	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	1,850	1,850	1,850	1,850	1,850	1,850
WICHITA FALLS CITY OF	COUNTY-OTHER	CLAY	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	292	286	280	271	263	253
WICHITA FALLS CITY OF	COUNTY-OTHER	WICHITA	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	170	176	182	191	199	209
WICHITA FALLS CITY OF	COUNTY-OTHER	WICHITA	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	140	140	140	140	140	140
WICHITA FALLS CITY OF	HOLLIDAY	ARCHER	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	299	310	319	320	306	295
WICHITA FALLS CITY OF	IOWA PARK	WICHITA	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	2,915	2,915	2,915	2,915	2,915	2,915
WICHITA FALLS CITY OF	LAKESIDE CITY	ARCHER	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	196	196	196	196	196	196
WICHITA FALLS CITY OF	MANUFACTURING	WICHITA	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	1,736	1,831	1,919	2,027	2,111	2,111
WICHITA FALLS CITY OF	OLNEY	YOUNG	BRAZOS	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	561	561	561	561	561	561
WICHITA FALLS CITY OF	COUNTY-OTHER	WICHITA	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	120	114	112	109	108	107
WICHITA FALLS CITY OF	COUNTY-OTHER	CLAY	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	420	420	420	420	420	420
WICHITA FALLS CITY OF	COUNTY-OTHER	ARCHER	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	140	140	140	140	140	140
WICHITA FALLS CITY OF	STEAM ELECTRIC POWER	WICHITA	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	360	360	360	360	360	360
WICHITA FALLS CITY OF	WICHITA FALLS	WICHITA	RED	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	6,097	5,753	5,410	5,066	4,722	4,379
WICHITA FALLS CITY OF	WICHITA FALLS	WICHITA	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	23,808	22,792	21,781	20,759	19,774	18,866
WICHITA FALLS CITY OF	COUNTY-OTHER	WICHITA	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	1,037	1,037	1,037	1,037	1,037	1,037
WICHITA FALLS CITY OF	COUNTY-OTHER	ARCHER	RED	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	420	420	420	420	420	420

Region B Wholesale Water Supplier Needs
(Ac-ft per Year)

WWP ID	WWP Name	WUG ID	WUG Name	WUG County	WUG Basin	R2010	R2020	R2030	R2040	R2050	R2060
191	REGIONAL WATER PROVIDER-WICHITA BASIN CHLORIDE CONTROL PROJECT	229	IRRIGATION	WICHITA	RED	0	0	0	0	0	0
67	WICHITA FALLS CITY OF	162	ARCHER CITY	ARCHER	RED	0	0	0	0	0	0
67	WICHITA FALLS CITY OF	185	COUNTY-OTHER	ARCHER	RED	0	0	0	0	0	0
67	WICHITA FALLS CITY OF	164	BURKBURNETT	WICHITA	RED	0	0	0	0	0	0
67	WICHITA FALLS CITY OF	190	COUNTY-OTHER	CLAY	RED	0	0	0	0	0	0
67	WICHITA FALLS CITY OF	199	COUNTY-OTHER	WICHITA	RED	0	0	0	0	0	0
67	WICHITA FALLS CITY OF	199	COUNTY-OTHER	WICHITA	RED	0	0	0	0	0	0
67	WICHITA FALLS CITY OF	171	HOLLIDAY	ARCHER	RED	0	0	0	0	0	0
67	WICHITA FALLS CITY OF	172	IOWA PARK	WICHITA	RED	0	0	0	0	0	0
67	WICHITA FALLS CITY OF	173	LAKESIDE CITY	ARCHER	RED	0	0	0	0	0	0
67	WICHITA FALLS CITY OF	203	MANUFACTURING	WICHITA	RED	0	0	0	0	0	0
67	WICHITA FALLS CITY OF	176	OLNEY	YOUNG	BRAZOS	0	0	0	0	0	0
67	WICHITA FALLS CITY OF	199	COUNTY-OTHER	WICHITA	RED	0	0	0	0	0	0
67	WICHITA FALLS CITY OF	190	COUNTY-OTHER	CLAY	RED	0	0	0	0	0	0
67	WICHITA FALLS CITY OF	185	COUNTY-OTHER	ARCHER	RED	0	0	0	0	0	0
67	WICHITA FALLS CITY OF	207	STEAM ELECTRIC POWER	WICHITA	RED	0	0	0	0	0	0
67	WICHITA FALLS CITY OF	184	WICHITA FALLS	WICHITA	RED	2,246	2,127	-181	-1,467	-2,744	-4,204
67	WICHITA FALLS CITY OF	199	COUNTY-OTHER	WICHITA	RED	0	0	0	0	0	0
67	WICHITA FALLS CITY OF	185	COUNTY-OTHER	ARCHER	RED	0	0	0	0	0	0

Region B Wholesale Water Provider Potentially Feasible Water Managment Strategy Supply
(Ac-ft per Year)

WWP Name	Project Name	Source Name	Source County	Source Basin	WUG Name	Selected	SS2010	SS2020	SS2030	SS2040	SS2050	SS2060
REGIONAL WATER PROVIDER-WICHITA BASIN CHLORIDE CONTROL PROJECT	WICHITA BASIN CHLORIDE CONTROL PROJECT	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	IRRIGATION	Recommended	8,800	26,500	26,500	26,500	26,500	26,500
WICHITA FALLS CITY OF	CONSTRUCT LAKE RINGGOLD	RINGGOLD LAKE/RESERVOIR	RESERVOIR	RED	WICHITA FALLS	Recommended	0	0	0	0	27,000	27,000
WICHITA FALLS CITY OF	INCREASE WATER CONSERVATION POOL AT LAKE KEMP	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	WICHITA FALLS	Recommended	0	3,364	3,366	3,358	3,350	3,340
WICHITA FALLS CITY OF	MUNICIPAL CONSERVATION	CONSERVATION	WICHITA	RED	WICHITA FALLS	Recommended	124	533	548	556	562	1,367
WICHITA FALLS CITY OF	WASTEWATER REUSE	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	WICHITA FALLS	Alternate	0	0	0	11,000	11,000	11,000

Region B Wholesale Water Provider Water Managment Strategy Cost

WWP Name	Project Name	Source Name	Source County	Source Basin	Capital Cost	AC2010	AC2020	AC2030	AC2040	AC2050	AC2060
REGIONAL WATER PROVIDER-WICHITA BASIN CHLORIDE CONTROL PROJECT	WICHITA BASIN CHLORIDE CONTROL PROJECT	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	$95,450,000	$7,572,425	$7,572,425	$7,572,425	$7,572,425	$1,245,500	$1,245,500
WICHITA FALLS CITY OF	CONSTRUCT LAKE RINGGOLD	RINGGOLD LAKE/RESERVOIR	RESERVOIR	RED	$0	$0	$0	$0	$0	$0	$0
WICHITA FALLS CITY OF	INCREASE WATER CONSERVATION POOL AT LAKE KEMP	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	$26,000	$0	$1,634	$1,680	$0	$0	$0
WICHITA FALLS CITY OF	MUNICIPAL CONSERVATION	CONSERVATION	WICHITA	RED	$0	$0	$0	$0	$0	$0	$0
WICHITA FALLS CITY OF	WASTEWATER REUSE	WICHITA LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	$57,100,000	$0	$0	$0	$847,000	$8,467,000	$3,488,000

APPENDIX D

REGIONAL WATER PLANNING GROUP B

PLAN COMMENTS AND RESPONSES

PLAN COMMENTS

June 28, 2010

Mr. Curtis W. Campbell
Chairman, Region B Regional Water Planning Group
c/o Red River Authority of Texas
P.O. Box 240
Wichita Falls, Texas 76307-0240

Re: Texas Water Development Board Comments for the Region B Regional Water Planning Group Initially Prepared Plan, Contract No. 0904830861

Dear ~~Mr. Campbell~~: Curtis

Texas Water Development Board (TWDB) Staff completed a review of the Initially Prepared Plan (IPP) submitted by March 1, 2010 on behalf of the Region B Regional Water Planning Group. The attached comments (Attachments A and B) follow this format:

- Level 1: Comments, questions, and online planning database revisions that must be satisfactorily addressed in order to meet statutory, agency rule, and/or contract requirements; and
- Level 2: Comments and suggestions for consideration that may improve the readability and overall understanding of the regional plan.

The TWDB's statutory requirement for review of potential interregional conflicts under Title 31, Texas Administrative Code (TAC) §357.14 will not be completed until submittal and review of adopted regional water plans.

Title 31, TAC §357.11(b) requires the regional water planning group to consider timely agency and public comment. Section 357.10(a)(3) of the TAC requires the final adopted plan include summaries of all timely written and oral comments received, along with a response explaining any resulting revisions or why changes are not warranted.

Copies of TWDB's Level 1 and 2 written comments and the region's responses must be included in the final, adopted regional water plan.

If you have any questions, please do not hesitate to contact Virginia Sabia at (512) 936-9363.

Sincerely,

Carolyn L. Brittin
Deputy Executive Administrator
Water Resources Planning and Information

Attachments (3)

c w/att: Mr. Kerry D. Maroney, Biggs & Mathews, Inc.

ATTACHMENT A

TWDB Comments on Initially Prepared 2011 Region B Regional Water Plan

LEVEL 1. Comments and questions must be satisfactorily addressed in order to meet statutory, agency rule, and/or contract requirements.

Executive Summary

1. Page ES-10, Table ES-6; Tables 4-1 and 4-3: It appears that total county surplus/shortages were calculated incorrectly by subtracting total [county-wide] supply from total [county-wide] demand. Please revise to reflect total county water needs as the sum of the individual needs of each water user group in the county; needs that are calculated based on each water user group's own demands and supplies. *[Title 31 Texas Administrative Code (TAC) §357.7(a)(4)(A)]*

Chapter 2

2. The plan does not present population and categories of water use by counties and river basins. Please present population and demand projections by counties and river basins. *[31 TAC §357.7(a)(2)(A)(iv)) and (a)(3)(F)(iv)]*

3. The plan does not present wholesale water provider water use by counties and river basins. Please present population and demand projections by counties and river basins. *[31 TAC §357.7(a)(2)(A)(iv) and (a)(2)(B)]*

Chapter 3

4. It is not clear which water availability model runs were used in the plan (e.g. page 3-8 for Lake Electra). Please clearly reference the water availability model runs utilized in all appropriate text and tables. *[31 TAC §357.7(a)(3)(C)]*

5. Page 3-22: Please describe how each groundwater conservation district management plan for the three groundwater conservation districts in Region B were considered in developing the plan. *[31 TAC 357.5(k)(1)(D)]*

6. Page 3-22: Northern Trinity and Woodbine Aquifers priority groundwater management areas are not referred to in the plan. Please describe how water availability requirements promulgated by a county commissioners court pursuant to Texas Water Code §35.019 were considered in developing the regional water plan. *[31 TAC §357.5(k)(1)(G)]*

7. Page 3-26, Tables 3-8 and 3-9: Tables present a single groundwater availability number. Please present groundwater availability volumes for all planning decades or clarify if volumes are the same in all decades.

8. Page 3-26, Table 3-8: When totaled Table 3-8 does not match Table ES-5 (e.g. Table ES-5 availability is 189,960 acft/yr and Table 3-8 totals 183,524 acft/yr). Please revise plan as appropriate.

Chapter 4

9. Pages 4-31, 4-35: The proposed Lake Ringgold is downstream of Listed Segment 0211 of the Little Wichita River, per Section §303(d), Texas Clean Water Act, 2007. Please explain whether the strategy takes into account related water quality issues and whether this might impact the reservoir in the future. *[31 TAC §357.7(a)(12)]*

10. *(Attachment B)* Comments on the online planning database (i.e. DB12) are herein being provided in spreadsheet format. These Level 1 comments are based on a direct comparison of the online planning database against the Initially Prepared Regional Water Plan document as submitted. The table only includes numbers that do not reconcile between the plan (left side of spreadsheet) and online database (right side of spreadsheet). An electronic version of this spreadsheet will be provided upon request.

11. *(Attachment C)* Based on the information provided to date by the regional water planning groups, TWDB has also attached a summary, in spreadsheet format of apparent unmet water needs that were identified during the review of the online planning database and Initially Prepared Regional Water Plan. *[Additional TWDB comments regarding the general conformance of the online planning database (DB12) format and content to the Guidelines for Regional Water Planning Data Deliverables (Contract Exhibit D) are being provided by TWDB staff under separate cover as 'Exception Reports']*

LEVEL 2. Comments and suggestions that might be considered to clarify or enhance the plan.

General Comment

1. Data units are not indicated in some plan tables (e.g. Table ES-5) Please consider indicating data units in all figures and tables throughout the plan. *[Contract Exhibit "D" Section 2.2]*

2. Please note acronyms in first use (e.g., million gallons per day (mgd), cubic feet per second (cfs), gallons per minute (gpm) or million gallons per day (mgd). *[Contract Exhibit "D" Section 2.2]*

3. Please consider adding reference labels to all tables in the plan (e.g. table on page ES-21).

Executive Summary

4. Page ES-23, Table ES-14: Comparing the text on pages ES-21, 22 and Table ES-14, it is not clear what is meant by the reference "New supplies include conservation savings." Please consider adding clarifying language regarding the source and quantity of conservation savings, for example, associated with conservation water management strategies.

Chapter 4

5. Attachment 4-1: Please consider labeling the two tables ("Strategy Evaluation Matrix" and "Summary of Environmental Assessment") so they are uniquely identified in Attachment 4-1.

ATTACHMENT B : LEVEL 1 COMMENTS-INITIALLY PREPARED REGIONAL WATER PLAN VS. ONLINE PLANNING DATABASE REVIEW

REGION B

		IPP document reference:		Non-matching numbers														
				IPP document number							Online Planning Database (DB12) number							
	Item	Page number	Table number	non-decadal number	2010	2020	2030	2040	2050	2060	non-decadal number	2010	2020	2030	2040	2050	2060
B	Population for 2060	ES-3	2nd paragraph							220,000							221,734
B	WUG shortages, Archer County Irrigation	ES-10	ES-7		-1,301	-1,344	-1,386	-1,426	-1,465	-1,584		-1300	-1343	-1385	-1425	-1464	-1583
B	WUG shortages, Clay County-Other	ES-10	ES-7					0	0	0					75	237	312
B	WUG shortages, Montague County-Other	ES-10	ES-7				-295		-290	-295				-294		-291	-294
B	WUG shortages, Montague County Mining	ES-10	ES-7		-177	-153	-145	-149	-162	-162		-225	-201	-193	-197	-210	-210
B	Conservation Savings for Archer County-Other	ES-15	ES-12		7	11	14	16	17	18		10	15	19	23	24	25
B	Conservation Savings for Clay County-Other	ES-15	ES-12		16	42	45	45	41	39		30	80	85	85	78	74
B	Summary of Recommended Strategies, Additional Municipal Conservation WMS volume	ES-23	ES-14		197	764	799	841	857	1,668		270	959	1,024	1,073	1,088	1897
B	Summary of Recommended Strategies, Increase Cons Elev of Lake Kemp WMS volume	ES-23	ES-14			24,834	24,776	24,718	24,660	24,600			28,198	28,142	28,076	28,010	
B	Summary of Recommended Strategies, Groundwater Development - Montague County-Other WMS volume	ES-23	ES-14		485	554	572	584	567	572		584	584	584	584	584	584
B	Lake Kemp/diversion system supplies	3-3	3.1		100,983	96,466	91,949	87,432	82,915	78,400		62,383	58,866	55,349	51,832	48,315	44,800
B	Wichita System supplies	3-3	3.1		45,800	45,400	45,000	44,600	44,200	43,800		34,883	33,966	33,049	32,132	31,215	30,300
B	Lake Amon Carter Firm Yield	3-3	3.1		2,107	2,014	1,921	1,828	1,735	1,640		1,450	1,400	1,350	1,300	1,250	1,200
B	North Fork Buffalo Creek Reservoir Firm Yield	3-3	3.1		840	840	840	840	840	840		690	680	670	660	650	640
B	Lake Cooper/Olney Firm Yield	3-3	3.1		960	960	960	960	960	960		760	760	760	760	760	760
B	Greenbelt Lake/Reservoir Firm Yield	3-3	3.1		8,297	8,164	8,031	7,898	7,765	7,630		6,864	6,728	6,592	6,456	6,320	6,181
B	Clay Co Petrolia run-of-river availability	3-4	3-2		107	107	107	107	107	107		67	67	67	67	67	67
B	Henrietta run-of-river availability	3-4	3-2		1,450	1,450	1,450	1,450	1,450	1,450		912	912	912	912	912	912
B	Clay Co Industrial run-of-river	3-4	3-2		127	127	127	127	127	127		na	na	na	na	na	na
B	Wichita Co WCWID#2 run-of-river irrigation	3-4	3-2		8,850	8,850	8,850	8,850	8,850	8,850		0	0	0	0	0	0
B	Wichita Co Iowa Park/Gordon run-of-river	3-4	3-2		555	555	555	555	555	555		1,224	1,216	1,209	1,200	1,193	1,193
B	Cottle Co Seymour GW Availability	3-26	3-8		na	na	na	na	na	na		8,410	8,410	8,410	8,410	8,410	8,410
B	Montague Co., Red Basin, Trinity Aquifer	3-26	3-8		129	129	129	129	129	129		239	239	239	239	239	239
B	Montague Co., Trinity Basin, Trinity Aquifer	3-26	3-8		2,545	2,545	2,545	2,545	2,545	2,545		2,443	2,443	2,033	2,033	1,667	1,667
B	Montague Co., Red Basin, Other Aquifer	3-28	3-11		548	548	548	548	548	548		815	815	815	815	815	815
B	Montague Co., Trinity Basin, Other Aquifer	3-28	3-11		505	505	505	505	505	505		603	603	603	603	603	603
B	Wilbarger Co., Red Basin, Other Aquifer	3-28	3-11		11	11	11	11	11	11		na	na	na	na	na	na
B	Wichita Co., Red Basin, Other Aquifer	3-28	3-11		na	na	na	na	na	na		658	658	658	658	658	658
B	Archer Co. supplies	3-31	3-13		7,518	7,367	7,239	7,097	6,921	6,772		7,479	7,329	7,200	7,058	6,883	6,733
B	Cottle Co. supplies	3-31	3-13		5,792	5,794	5,795	5,797	5,797	5,797		5,791	5,793	5,794	5,796	5,796	5,796
B	Hardeman Co. supplies	3-31	3-13		8,677	8,660						8,678	8,661				
B	Montague Co. supplies	3-31	3-13		6,334	6,267	6,200	6,133	6,066	6,000		6,287	6,220	6,153	6,086	6,019	5,954
B	Wichita Co. supplies	3-31	3-13			74,476	71,241	68,002	64,806				74,474	71,238	67,998	64,801	
B	Wilbarger Co. supplies	3-31	3-13		55,552	54,823	54,094	53,365	52,636	51,908		46,052	45,323	44,594	43,865	43,136	42,408
B	Young Co. supplies	3-31	3-13		1,379	1,379	1,379	1,379	1,379	1,379		1,369	1,369	1,369	1,369	1,369	1,369
B	Grand Total supplies by County	3-31	3-13		183,462	179,175	174,921	170,633	166,377	162,079		173,866	169,578	165,321	161,032	156,777	152,484
B	Wichita Falls WWP Wichita System Supply	3-32	3-14		34,884	33,968	33,052	32,136	31,220			34,883	33,966	33,049	32,132	31,215	
B	Total Firm Supplies to Region B	3-33	3-15		375,150	370,100	365,073	360,028	355,001	349,921		na	na	na	na	na	na
B	Archer C-O shortage	4-1	3rd paragraph							40,366							40,445
B	Projected Water Shortages for Wichita Falls	4-5	Table 4-4				-766	-2,077	-3,384	-4,876				-184	-1,471	-2,749	-4,204
B	Byers conservation WMS volume	4-19	Table 4-9		na	na	na	na	na	na		1	3	3	3	3	3
B	Electra conservation WMS volume	4-19	Table 4-9		na	na	na	na	na	na		10	28	33	34	36	38
B	Vernon conservation WMS volume	4-19	Table 4-9		na	na	na	na	na	na		45	122	144	148	148	146
B	Clay C-O conservation WMS volume	4-19	Table 4-9		16	42	45	45	41	39		30	80	85	85	78	74
B	Archer C-O conservation WMS volume	4-19	Table 4-9		7	11	14	16	17	18		10	15	19	23	24	25
B	Archer C-O Project Costs for Conservation Supply	4-20	Table 4-11		$10,000	$10,000	$10,000	$10,000	$10,000	$10,000		$13,750	$13,750	$13,750	$13,750	$13,750	$13,750
B	Clay C-O Project Costs for Conservation Supply	4-20	Table 4-11		$10,000	$10,000	$10,000	$10,000	$10,000	$10,000		$18,920	$18,920	$18,920	$18,920	$18,920	$18,920
B	Byers conservation WMS annual cost	4-20	Table 4-11		na	na	na	na	na	na		$0	$0	$0	$0	$0	$0
B	Electra conservation WMS annual cost	4-20	Table 4-11		na	na	na	na	na	na		$10,712	$15,263	$15,263	$15,263	$15,263	$15,263
B	Vernon conservation WMS annual cost	4-20	Table 4-11		na	na	na	na	na	na		$15,436	$21,550	$21,550	$21,550	$21,550	$21,550
B	Capital Cost & Annual costs - Clay C-O Purchase Water from Local Provider	4-23	4th paragraph	$ 364,000	$ 326,000						$ 342,500	$ 322,500					
B	Annual Costs for Montague C-O Develop additional GW	4-25	4th paragraph		$ 359,000							$ 329,070	$ 329,070	$ 137,580	$ 137,580	$ 137,580	$ 137,580
B	Annual cost for City of Lakeside- purchase water from local provider	4-30	last paragraph		$ 12,707							$ 12,708	$ 12,708	$ 12,708	$ 12,708	$ 12,708	$ 12,708
B	Lake Kemp Reallocation WMS volume	4-42	table 4-13			24,834	24,776	24,718	24,660	24,660			24,372	24,314	24,256	24,198	24,138
B	Enclose Laterals in Pipe Annual Cost	4-43	last paragraph		$ 674,378							$ 677,768	$ 677,678	$ 6,778	$ 6,778	$ 6,778	$ 6,778

REGION B

		IPP document reference:		*Non-matching numbers* IPP document number							Online Planning Database (DB12) number						
Region ??	Item	Page number	Table number	non-decadal number	2010	2020	2030	2040	2050	2060	non-decadal number	2010	2020	2030	2040	2050	2060
B	Total Capital Cost and annual cost for Montague Co Mining - Purchase Water From Local Provider	4-46	5th paragraph	$ 412,000	$ 241,000						$ 824,000	$ 482,074					
B	Wichita Basin Chloride Control Project - Annual Costs	4-54	2nd paragraph		$ 7,572,425							$ 7,579,000	$ 75,579,000	$ 7,579,000	$ 7,579,000	$ 1,245,500	$ 1,245,500
B	Archer C-O Municipal Conservation WMS Supply	4-58	Table	18								10	15	19	23	24	25
B	Lakeside, Municipal Conservation WMS Supply	4-58	Table		na	na	na	na	na	na		3	9	10	11	11	11
B	Archer County WMS Total volume	4-58	Table	1,900								321	1,676	1,723	1,768	1,808	1,928
B	Byers Conservation WMS, Clay County	4-59	Table		na	na	na	na	na	na		1	3	3	3	3	3
B	Clay C-O Municipal Conservation WMS Supply	4-59	Table	49								30	80	85	85	78	74
B	Clay Co Total WMS Supply	4-59	Table	611								264	647	630	605	567	584
B	Montague C-O Municipal Conservation WMS volume	4-60	Table		na	na	na	na	na	na		8	34	34	61	69	72
B	Montague Co Mining Purchase WMS volume	4-60	Table	177								354	354	354	354	354	354
B	Montague Co WMS total volume	4-60	Table									964	1,050	1,052	1,250	1,259	1,262
B	Montague C–O Purchase Water from Local Provider Alternative WMS Supply	4-60	Table		584							968	968	968	968	968	968
B	Electra - Municipal Conservation volume in Wichita Co	4-60	Table		na	na	na	na	na	na		10	28	33	34	36	38
B	Wichita Co WMS Total volume	4-60	Table	63,049								13,880	33,702	28,926	36,987	63,204	63,087
B	Vernon Conservation WMS volume in Wilbarger Co	4-62	Table		na	na	na	na	na	na		45	122	144	148	148	146
B	Total WMS supply for Wilbarger Co	4-62	Table							10,864		194	4,071	8,822	9,555	10,284	11,010
B	Capital Cost & Annual costs - Clay C-O Purchase Water from Local Provider	Att 4-2, p 3		$ 364,000	$ 326,000						$342,500	$322,500					
B	Wichita County Manufacturing Annual Cost	Att 4-2, p 12		$ 489,230							$ 489,258						
B	Lockett Water System capital cost and annual cost	Att 4-2, p 16		$1,658,700 (Cap) $247,000 (AC)							$1,272,000 (Cap) $202,000 (AC)						
B	Enclose Laterals in Pipe Annual Cost	Att 4-2, p 18			$ 674,378							$677,768	$677,678	$6,778	$6,778	$6,778	$6,778
B	Montague County Mining Capital and Annual Cost	Att 4-2, p 20-21		$654,000 (Cap) $79,025 (AC)							na						
B	Total Capital Cost for Montague Co Mining - Purchase Water from Local Provider	Att 4-2, p 21		$ 412,000							$824,000						
B	Annual Costs for Montague C-O Develop additional GW	Att 4-2, p 4			$ 359,000							$329,070	$329,070	$137,580	$137,580	$137,580	$137,580
B	Annual cost for City of Lakeside- purchase water from local provider	Att 4-2, p 9			$ 12,707							$12,708	$12,708	$12,708	$12,708	$12,708	$12,708
B	Annual costs for Wichita Co Manufacturing - Purchase water from local provider	Att 4-2, p 12			$ 489,230							$489,258	$489,258	$489,258	$489,258	$489,258	$489,258
B	Wichita Basin Chloride Control Project - Annual Costs	Att 4-2, p 22			$ 7,572,425							$7,579,000	$75,579,000	$7,579,000	$7,579,000,000	$1,245,500	$1,245,500
B	Conservation Relative to Total New Supplies, Additional Municipal Conservation volume	6-11	6-2		197	764	799	841	857	1,668		270	959	1,024	1,073	1,088	1897
B	Conservation Relative to Total New Supplies, Increase Cons Elev of Lake Kemp WMS volume	6-11	6-2			24,834	24,776	24,718	24,660	24,600			28,198	28,142	28,076	28,010	
B	Conservation Relative to Total New Supplies,, Groundwater Development - Montague County-Other	6-11	6-2		485	554	572	584	567	572		584	584	584	584	584	584

REGION B

WATER USER GROUPS WITH APPARENT UNMET NEEDS

WUG Name	WUG Region	WUG County	WUG Basin
IRRIGATION	B	ARCHER	RED
IRRIGATION	B	CLAY	RED
IRRIGATION	B	WICHITA	RED

TEXAS PARKS & WILDLIFE

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June 18, 2010

Mr. Curtis W. Campbell
Red River Authority of Texas
P.O. Box 240
Wichita Falls, TX 76307

Re: 2010 Region B Initially Prepared Plan

Dear Mr. Campbell:

Thank you for the opportunity to review and comment on the 2010 Initially Prepared Regional Water Plan (IPP) for Region B. Texas Parks and Wildlife (TPW) acknowledges the time, money and effort required to produce the regional water plan as mandated by Senate Bill 1 of the 75th Legislature. A number of positive steps have been taken since the first planning cycle to advance the issue of environmental protection. For example, the regional water planning groups are required by TAC §357.7(a)(8)(A), to perform a "quantitative reporting of environmental factors including effects on environmental water needs, wildlife habitat, cultural resources, and effect of upstream development on bays, estuaries, and arms of the Gulf of Mexico" when evaluating water management strategies (WMS). Quantification of environmental impacts is a critical step in planning for our state's future water needs while also protecting environmental resources.

TPW staff has reviewed the IPP with a focus on the following questions:

- Does the plan include a quantitative reporting of environmental factors including the effects on environmental water needs and habitat?
- Does the plan include a description of natural resources and threats to natural resources due to water quantity or quality problems?
- Does the plan discuss how these threats will be addressed?
- Does the plan describe how it is consistent with long-term protection of natural resources?
- Does the plan include water conservation as a water management strategy? Reuse?
- Does the plan recommend any stream segments be nominated as ecologically unique?
- If the plan includes strategies identified in the 2006 regional water plan, does it address concerns raised by TPWD at that time?

According to the Region B IPP the region will have adequate water supplies to meet the needs as whole up to the year 2019. However, by year 2020, the region is projected to have a supply shortage of 716 acre-feet per year and by 2060 the shortage will increase to 16,112 acre-feet per year. Individual shortages for water user groups in 2060 sum to 40,336 ac-ft/yr. Increasing the conservation pool level at Lake Kemp is a high priority strategy to meet many of these identified water shortages. Other important recommended water management strategies include enclosing lateral canals in pipes and the construction of Lake Ringgold. The IPP also relies on conservation measures to

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reduce municipal water waste. These include compliance with the State Water Efficiency Plumbing Act, the use of more efficient washing machines in the future, and public and school education. TPWD encourages Region B to also consider land stewardship (brush control/management) that benefits wildlife and aquatic habitat as well as conserves water. Reuse is also included as a water management strategy for the City of Bowie and as an alternate strategy for the City of Wichita Falls. Completion of the Red River Chloride Control Project (RRCCP) is also recommended as a "regional strategy" to address the high dissolved solids concentrations in the western portions of the region. The RRCCP is not listed in the table of recommended water management strategies (Table ES-14) and it is unclear to TPWD staff how this project fits into the official categories of "recommended" and "alternative" water management strategies. As noted in the IPP, TPWD staff has concerns regarding the impacts of chloride control projects on fish and wildlife resources and will remain engaged in monitoring and environmental response programs.

In general the Region B IPP does not include a quantitative reporting of environmental factors including the effects on environmental water needs and habitat. However the IPP does include a brief description of natural resources including threats to those natural resources such as declines to spring flows, grasslands, and native fauna. The IPP does not include a description of how natural resources will be protected, with the exception of impacts associated with the RRCCP, which are to be addressed by the project's monitoring and mitigation plan. For areas in the Region where groundwater is the primary source of water supply, emphasis should be placed on protecting springs that support fish and wildlife. TPWD has previously expressed reservations about the potential impacts of Lake Ringgold on to fish and wildlife resources.

The plan does not recommend nomination of any stream segments as ecologically unique. As in the 2006 plan, the IPP states that the planning group is "committed to the protection and conservation of unique and sensitive areas within the region" and a "more comprehensive study with supporting data is necessary to accurately characterize and evaluate ... stream segments." At this time, no studies have been defined or proposed. TPWD is available to assist with this effort.

Thank you for your consideration of these comments. TPWD looks forward to continuing to work with the planning group to develop water supply strategies that not only meet the future water supply needs of the region but also preserve the ecological health of the region's aquatic resources. Please contact Cindy Loeffler at (512) 389-8715 if you have any questions or comments.

Sincerely,

Ross Melinchuk,
Deputy Executive Director, Natural Resources

RM:CL:ms

PLAN RESPONSES

BIGGS & MATHEWS INC.
Consulting Engineers

August 11, 2010

Curtis W. Campbell, Chairman
Regional Water Planning Group – Area B
Red River Authority of Texas
3000 Hammon Road
Wichita Falls, TX 76310-7500

RE: Comments/Responses to 2011
Initially Prepared Plan (IPP)
For Region B Regional Planning Area

Dear Mr. Campbell:

In accordance with the Texas Water Development Board (TWDB) requirements set forth in TAC Section 357.10 (a)(3) the Regional Water Planning Group (RWPG) Region B should consider approving certain revisions in the 2011 IPP based on the TWDB's written comments and other Public/Agency comments received relative to the 2011 IPP.

TWDB Comments – Letter Dated June 28, 2010

Level 1 Comments:

Executive Summary

1. Comment: On page ES-10 (Table ES-6) and Tables 4-1 and 4-3, it appears that total county surplus/shortages were calculated incorrectly by subtracting total (county-wide) supply from total (county-wide) demand. Please revise to reflect total county water needs as the sum of the individual needs of each water user group in the county; needs that are calculated based on each water user group's own demands and supplies.

   Response: These tables represent the surplus or shortage on a county-wide basis. The needs of individual water groups are shown in different tables (see tables ES-7 and 4-2). A footnote was added in Table 4-1 to clarify the intent of the table.

Chapter 2 – Population and Water Use Projections

2. Comment: The plan does not present population and categories of water use by counties and river basins. Please present population and demand projections by counties and river basins.

   Response: Population and Demand projections by county and river basin is shown in Attachment 2-1.

3. Comment: The plan does not present wholesale water provider water use by county and river basin. Please provide demand projections by county and river basin.

   Response: Wholesale water provider demand projections are shown by county and river basin in Appendix A.

Chapter 3: Evaluations of Current Water Supplies

4. Comment: It is not clear which water availability model runs were used in the plan. Please clearly reference the water availability model runs utilized in all appropriate text and tables.

   Response: In accordance with the TWDB rules for regional water planning, the TCEQ-approved Water Availability Models (WAMs) were used to determine surface water supplies. See Section 3.1 for a discussion on surface water availability. The discussion for Lake Electra states the available supply using the WAM. No changes made to the plan.

5. Comment: On page 3-22, please describe how each groundwater conservation district management plan for the three groundwater conservation districts in Region B were considered in developing the plan.

   Response: The groundwater supplies were determined as discussed in Section 3.2. The groundwater district plans were not considered for availability determination. The Managed Available Groundwater values were used for the Trinity Aquifer. For the other major and minor aquifers, an estimate of effective recharge was used. This was checked against the findings of the GAMs. The values used for planning are generally more restrictive than the GCD rules that state pumping limits per acre or Section.

6. Comment: On page 3-22, Northern Trinity and Woodbine Aquifers priority groundwater management areas are not referred to in the plan. Please describe how water availability requirements promulgated by a county commissioners court pursuant to Texas Water Code 35.019 were considered in developing the regional water plan.

   Response: The priority groundwater management area (PGMA) for the Northern Trinity Aquifer includes Montague County in Region B. There is no Woodbine Aquifer in Region B. PGMAs are a tool used by TCEQ to identify areas in need of groundwater management through Groundwater Conservation Districts (GCD). There is a GCD in Montague County (Upper Trinity Groundwater District). In accordance to TWDB rules and HB 1763, regional water plans are to use managed available groundwater (MAG) numbers, if available, for groundwater availability. Region B adopted the MAG values for the Trinity Aquifer in Montague County. This is discussed in Section 3.2. No changes were made to the plan.

7. Comment: On page 3-26, Tables 3-8 and 3-9 present a single groundwater availability number. Please present groundwater availability volumes for all planning decades or clarify if volumes are the same in all decades.

   Response: A footnote was added to Table 3-8. This table shows the availability for the minor and major aquifers.

8. Comment: On page 3-26, Table 3-8, totals do not match Table ES-5. Please revise plan as appropriate.

   Response: The values listed in Table 3-8 include only the named major and minor aquifers. Estimates of available supply from undifferentiated alluvium, referred to "other" aquifer, are included in the summary table in the Executive Summary. The values for Other Aquifer are listed in Table 3-11. The numerical values have been checked and updated as needed for the final plan.

Chapter 4 – Identification, Evaluation, and Selection of Water Management Strategies

9. Comment: On pages 4-31 and 4-35, the proposed Lake Ringgold is downstream of listed segment 02.1.1 of the Little Wichita River. Please explain whether the strategy takes into account related water quality issues and whether this might impact the reservoir in the future.

   Response: Assessment unit 02 (east fork confluence to the Lake Arrowhead dam) of stream segment 0211 is identified on both the 2006 and 2008 Section 303(d) lists as not attaining the stream standard for dissolved oxygen. The segment is currently classified as 5b, indicating that a total maximum daily load (TMDL) assessment will be delayed pending confirmation of the stream standard. A change in the stream standard could result in removal or delisting of this segment. However, construction of Lake Ringgold would most likely result in a somewhat higher stream standard for dissolved oxygen and potentially nutrients for this segment. There are currently three permitted wastewater discharges within or upstream of this assessment unit. These dischargers may be impacted by higher stream standards, requiring a higher level of treatment and nutrient removal. This is an environmental impact that will need to be considered in the planning and permitting effort for the reservoir. The reservoir is not required to satisfy water needs until 2050. Therefore, there is sufficient time to address modification of existing wastewater plants to achieve future stream standards and satisfy protection of Lake Ringgold as a water supply reservoir. Chapter 4 of the Region B IPP was modified to include this additional information.

10. Comment: In Attachment B there are comments on the online planning database, there are numbers that do not match the numbers in the IPP.

Response: The DB12 has been reviewed for consistency with the Region B water plan and updated as needed. The responses and changes made are detailed on the attached table.

11. Comment: In Attachment C there are apparent un-met water needs that were identified during the review of the online planning database and the IPP.

Response: There will be unmet needs in Region B in 2010 due to shortages associated with irrigation supplies from Lake Kemp. This will be reconciled with the development of the recommended strategies. The text of the IPP on Page 4-43 has been modified to clarify this issue.

<u>Level 2 Comments:</u>

<u>General Comments</u>

1. Comment: Data units are not indicated in some plan tables. Please consider indicating data units in all figures and tables throughout the plan.

Response: Data units were noted as appropriate.

2. Comment: Please note acronyms in first use.

Response: A list of acronyms was prepared and included in the plan.

3. Comment: Please consider adding reference labels to all tables in the plan.

Response: Reference labels were provided as appropriate.

<u>Executive Summary</u>

4. Comment: Comparing the text on pages ES-21, 22 and Table ES-14, it is not clear what is meant by the reference "New Supplies include conservation saving." Please consider adding clarifying language regarding the source and quantity of conservation savings.

Response: For clarification purposes it was noted that the additional water included the quantity of water from conversation.

Chapter 4 – Identification, Evaluation, and Selection of Water Management Strategies

5. Comment: On Attachment 4-1, consider labeling the two tables so they are uniquely identified in Attachment 4-1.

   Response: The two tables are uniquely identified by their respective titles.

TEXAS PARKS AND WILDLIFE DEPARTEMENT COMMENTS -- LETTER DATED JUNE 18, 2010

1. Comment: TPWD encourages Region B to also include land stewardship (brush control/ management) that benefits wildlife and aquatic habitat as well as conserves water.

   Response: Region B recognizes that land stewardship provides a benefit to the State's natural resources by improving watershed productivity through increased surface water runoff and groundwater recharge. Support for State funding for land stewardship or brush control is identified as a regional recommendation in Chapter 8 and the Executive Summary. The water conservation and watershed productivity benefits of land stewardship cannot be adequately quantified as the benefits are dependent on many physical characteristics and land management factors. Land stewardship depends on individual landowners to implement the practice. As a result, there is significant uncertainty regarding the amount of brush control that may be implemented. There is also limited funding available to encourage landowners to implement brush control. The Natural Resources Conservation Service (NRCS) provides some cost-share assistance through the Environmental Quality Incentives Program (EQIP), and a few landowners are known to implement brush control maintenance without cost-share assistance. EQIP is a program included in the Farm Bill, and continuation depends upon reauthorization beyond 2012 and annual appropriations. There is no assurance that this program will continue through the planning period. Due to the uncertainties associated with quantification of the benefits of land stewardship, the amount of brush control that may be implemented by individual landowners, and the uncertainty of future funding that may be available to support implementation; Region B will not be including land stewardship as a recommended strategy.

2. Comment: Completion of the Red River Chloride Control Project (RRCCP) is also recommended as a "regional strategy" to address the high dissolved solids concentrations in the western portion the region. The RRCCP is not listed in the table of recommended water management strategies (Table ES-14) and it is unclear to TPWD staff how this project fits into the official categories of "recommended" and "alternative" water management strategies. As noted in the IPP, TPWD staff has concerns regarding impacts of chloride control projects on fish and wildlife resources and will remain engaged in monitoring and environmental response programs.

Response: The Wichita Basin Chloride Control Project (WBCCP) is a recommended regional strategy (pg 4-63) not the full RRCCP. The Executive Summary has been revised to include the WBCCP as a recommended regional strategy immediately following the review of recommended strategies for each county. The Wichita Basin and Pease River portions of the RRCCP remain in the list of items under "Recommendations Including Unique Ecological Stream Segments, Reservoir Sites, Legislative & Regional Policy Issues" in the Executive Summary and is also noted in Chapter 8. Lake Kemp and Lake Diversion currently serve as a major water supply source for Region B providing about 62% of the region's surface water supply. With the recommended strategy of increasing the conservation elevation of Lake Kemp this system will continue to provide a significant portion of the region's water supply. However, due to the high chloride, sulfate, and total dissolved solids (TDS) levels, use of this water is inefficient. Municipal systems have begun and will continue to use desalination processes to treat this water source. As a result, a significant volume of water is disposed as concentrate or reject that would otherwise be available for water supply. For example, Wichita Falls currently uses 14.5 million gallons per day (MGD) to produce 10 MGD (69%) of finished water, returning 4.5 MGD (31%) to the river as concentrated brine. In addition, use of this water for irrigation requires periodic excess irrigation to leach the accumulated salts below the root zone. Similarly, industrial cooling water uses require increased blow down and make-up water supply to maintain functionality of these systems. Implementation of the WBCCP will reduce or eliminate many of these inefficiencies of use and significantly reduce the volume of water required for these demands. Environmental issues related to the WBCCP were addressed in the Final Environmental Statement (FES) and in the Supplement to the FES (SFES). These studies found that the WBCCP is economically and environmentally feasible and the Record of Decision was signed in March 2004.

3. Comment: In general the Region B IPP does not include a quantitative reporting of environmental factors including the effects on environmental water needs and habitat. However, the IPP does include a brief description of natural resources including threats to those natural resources such as declines in spring flows, grasslands, and native fauna.

Response: This Region B IPP is an update of the 2006 plan. The two recommended strategies that may have effects on environmental water needs and habitat are the WBCCP and Lake Ringgold. The effects of the WBCCP have been addressed in separate environmental studies which are referenced in Chapter 4. The effects of Lake Ringgold were described in Chapters 4 and 5. It was noted that the Reservoir Site Protection Study (TWDB, Report 370, Reservoir Site Protection Study, July 2008) did not identify significant environmental or water quality concerns for the site. The analysis for the project assumed instream flow releases in accordance with the Consensus Criteria for Environmental Flow Needs. Flow releases from storage will reduce downstream impacts. Detailed environmental studies will be required during the permitting and design of this reservoir. Potential impacts and appropriate mitigation, if needed, will be addressed during the permitting process. Further quantitative evaluation and reporting of environmental factors including the effects on environmental water needs and habitat was beyond the scope of this current plan update. There will be no change in the final plan based on this comment.

4. Comment: The IPP does not include a description of how natural resources will be protected, with the exception of impacts associated with the WBCC project, which are to be addressed by the project's monitoring and mitigation plan.

   Response: This Region B IPP is an update of the 2006 plan. See response to previous comment as the environmental studies noted there are also applicable to this comment. As an update of the 2006 Regional Plan, a more detailed evaluation of natural resource protection was beyond the scope of the current planning effort. There will be no change in the final plan based on this comment.

5. Comment: For areas in the Region where groundwater is the primary source of water supply, emphasis should be placed on protecting springs that support fish and wildlife.

   Response: Springs within Region B are addressed in Chapter 3 (section 3.2.1). A study to evaluate the current status of these springs and use by fish and wildlife has not been conducted. This effort is beyond the scope of the current plan update, but may be addressed in future planning cycles. There will be no change in the final plan based on this comment.

6. Comment: TPWD has previously expressed reservations about the potential impacts of Lake Ringgold on to the fish and wildlife resources.

   Response: The effects of Lake Ringgold were described in Chapters 4 and 5. It was noted that the Reservoir Site Protection Study (TWDB, Report 370, Reservoir Site Protection Study, July 2008) did not identify significant environmental or water quality concerns for the site. The analysis for the project assumed instream flow releases in accordance with the Consensus Criteria for Environmental Flow Needs. Detailed environmental studies will be required during the permitting and design of this reservoir. Potential impacts and appropriate mitigation, if needed, will be addressed during the permitting process. Further evaluation of the impacts of Lake Ringgold on fish wildlife resources was beyond the scope of this current plan update. There will be no change in the final plan based on this comment.

7. Comment: It is disappointing that the plan does not recommend nomination of any stream segments as ecologically unique.

   Response: As noted in Chapter 8, (Page 8-7; 8.3.1), TPWD has previously identified three stream segments for designation as ecologically unique. Two of the segments are located within areas that currently offer protections and one segment lies in Oklahoma. There will be no change in the final plan based on this comment.

If you have any questions concerning the above information, please contact me.

Sincerely,

BIGGS & MATHEWS, INC.
Freese & Nichols
Alan Plummer & Assoc.

REGION B

Region IPP	Item	IPP document reference: Page number	Table number	Non-matching numbers — IPP document number: non-decadal number	2010	2020	2030	2040	2050	2060	Online Planning Database (DB12) number: non-decadal number	2010	2020	2030	2040	2050	2060	Response
B	Population for 2060	ES-3	2nd paragraph							220,000							221,734	
B	WUG shortages, Archer County Irrigation	ES-10	ES-7		-1,301	-1,344	-1,386	-1,426	-1,465	-1,584		-1300	-1343	-1385	-1425	-1464	-1583	Rounding differences due to split WUG. No changes made.
B	WUG shortages, Clay County-Other	ES-10	ES-7					0	0	0					75	237	312	Table is correct. No changes made.
B	WUG shortages, Montague County-Other	ES-10	ES-7				-295		-290	-295				-294		-291	-294	Rounding differences due to split WUG. No changes made.
B	WUG shortages, Montague County Mining	ES-10	ES-7		-177	-153	-145	-149	-162	-162		-225	-201	-193	-197	-210	-210	Corrected DB12. No changes made to IPP.
B	Conservation Savings for Archer County-Other	ES-15	ES-12		7	11	14	16	17	18		10	15	19	23	24	25	Corrected DB12. No changes made to IPP.
B	Conservation Savings for Clay County-Other	ES-15	ES-12		16	42	45	45	41	39		30	80	85	85	78	74	Corrected DB12. No changes made to IPP.
B	Summary of Recommended Strategies, Additional Municipal Conservation WMS volume	ES-23	ES-14		197	764	799	841	857	1,668		270	959	1,024	1,073	1,088	1897	Corrected DB12. No changes made to IPP.
B	Summary of Recommended Strategies, Increase Cons Elev of Lake Kemp WMS volume	ES-23	ES-14			24,834	24,776	24,718	24,660	24,600			28,198	28,142	28,076	28,010		Double counting WWP. DB12 and IPP are correct.
B	Summary of Recommended Strategies, Groundwater Development - Montague County-Other WMS volume	ES-23	ES-14		485	554	572	584	567	572		584	584	584	584	584	584	Change text in IPP
B	Lake Kemp/diversion system supplies	3-3	3.1		100,983	96,466	91,949	87,432	82,915	78,400		62,383	58,866	55,349	51,832	48,315	44,800	
B	Wichita System supplies	3-3	3.1		45,800	45,400	45,000	44,600	44,200	43,800		34,883	33,966	33,049	32,132	31,215	30,300	
B	Lake Amon Carter Firm Yield	3-3	3.1		2,107	2,014	1,921	1,828	1,735	1,640		1,450	1,400	1,350	1,300	1,250	1,200	Values shown for DB12 are safe yield, not firm yield.
B	North Fork Buffalo Creek Reservoir Firm Yield	3-3	3.1		840	840	840	840	840	840		690	680	670	660	650	640	DB12 and IPP are correct. No changes made.
B	Lake Cooper/Olney Firm Yield	3-3	3.1		960	960	960	960	960	960		760	760	760	760	760	760	
B	Greenbelt Lake/Reservoir Firm Yield	3-3	3.1		8,297	8,164	8,031	7,898	7,765	7,630		6,864	6,728	6,592	6,456	6,320	6,181	
B	Clay Co Petrolia run-of-river availability	3-4	3-2		107	107	107	107	107	107		67	67	67	67	67	67	
B	Henrietta run-of-river availability	3-4	3-2		1,450	1,450	1,450	1,450	1,450	1,450		912	912	912	912	912	912	
B	Clay Co Industrial run-of-river	3-4	3-2		127	127	127	127	127	127		na	na	na	na	na	na	
B	Wichita Co WCWID#2 run-of-river irrigation	3-4	3-2		8,850	8,850	8,850	8,850	8,850	8,850		0	0	0	0	0	0	DB12 corrected.
B	Wichita Co Iowa Park/Gordon run-of-river	3-4	3-2		555	555	555	555	555	555		1,224	1,216	1,209	1,200	1,193	1,193	
B	Cottle Co Seymour GW Availability	3-26	3-8		na	na	na	na	na	na		8,410	8,410	8,410	8,410	8,410	8,410	
B	Montague Co., Red Basin, Trinity Aquifer	3-26	3-8		129	129	129	129	129	129		239	239	239	239	239	239	
B	Montague Co., Trinity Basin, Trinity Aquifer	3-26	3-8		2,545	2,545	2,545	2,545	2,545	2,545		2,443	2,443	2,033	2,033	1,667	1,667	
B	Montague Co., Red Basin, Other Aquifer	3-28	3-11		548	548	548	548	548	548		815	815	815	815	815	815	IPP corrected.
B	Montague Co., Trinity Basin, Other Aquifer	3-28	3-11		505	505	505	505	505	505		603	603	603	603	603	603	
B	Wilbarger Co., Red Basin, Other Aquifer	3-28	3-11		11	11	11	11	11	11		na	na	na	na	na	na	DB12 corrected.
B	Wichita Co., Red Basin, Other Aquifer	3-28	3-11		na	na	na	na	na	na		658	658	658	658	658	658	IPP corrected.
B	Archer Co. supplies	3-31	3-13		7,518	7,367	7,239	7,097	6,921	6,772		7,479	7,329	7,200	7,058	6,883	6,733	DB12 corrected. Differences of 2 or less are rounding differences and were not corrected.
B	Cottle Co. supplies	3-31	3-13		5,792	5,794	5,795	5,797	5,797	5,797		5,791	5,793	5,794	5,796	5,796	5,796	Rounding differences due to split WUG. No changes
B	Hardeman Co. supplies	3-31	3-13		8,677	8,660						8,678	8,661					made.
B	Montague Co. supplies	3-31	3-13		6,334	6,267	6,200	6,133	6,066	6,000		6,287	6,220	6,153	6,086	6,019	5,954	DB12 corrected. Differences of 2 or less are rounding
B	Wichita Co. supplies	3-31	3-13			74,476	71,241	68,002	64,806				74,474	71,238	67,998	64,801		differences and were not corrected.
B	Wilbarger Co. supplies	3-31	3-13		55,552	54,823	54,094	53,365	52,636	51,908		46,052	45,323	44,594	43,865	43,136	42,408	Corrected IPP. DB12 is correct.
B	Young Co. supplies	3-31	3-13		1,379	1,379	1,379	1,379	1,379	1,379		1,369	1,369	1,369	1,369	1,369	1,369	Corrected DB12.
B	Grand Total supplies by County	3-31	3-13		183,462	179,175	174,921	170,633	166,377	162,079		173,866	169,578	165,321	161,032	156,777	152,484	Corrected IPP.
B	Wichita Falls WWP Wichita System Supply	3-32	3-14		34,884	33,968	33,052	32,136	31,220			34,883	33,966	33,049	32,132	31,215		DB12 is correct.
B	Total Firm Supplies to Region B	3-33	3-15		375,150	370,100	365,073	360,028	355,001	349,921		na	na	na	na	na	na	Comment?
B	Archer C-O shortage	4-1	3rd paragraph							40,366							40,445	Differences are due to different calculations. The IPP numbers are the aggregated WUG, not absolute sum of the needs of the split WUG. No changes made.
B	Projected Water Shortages for Wichita Falls	4-5	Table 4-4				-766	-2,077	-3,384	-4,876				-184	-1,471	-2,749	-4,204	Corrections made.
B	Byers conservation WMS volume	4-19	Table 4-9		na	na	na	na	na	na		1	3	3	3	3	3	Deleted from DB12
B	Electra conservation WMS volume	4-19	Table 4-9		na	na	na	na	na	na		10	28	33	34	36	38	Deleted from DB12
B	Vernon conservation WMS volume	4-19	Table 4-9		na	na	na	na	na	na		45	122	144	148	148	146	Deleted from DB12
B	Clay C-O conservation WMS volume	4-19	Table 4-9		16	42	45	45	41	39		30	80	85	85	78	74	Corrected
B	Archer C-O conservation WMS volume	4-19	Table 4-9		7	11	14	16	17	18		10	15	19	23	24	25	Corrected
B	Archer C-O Project Costs for Conservation Supply	4-20	Table 4-11		$10,000	$10,000	$10,000	$10,000	$10,000	$10,000		$13,750	$13,750	$13,750	$13,750	$13,750	$13,750	Corrected
B	Clay C-O Project Costs for Conservation Supply	4-20	Table 4-11		$10,000	$10,000	$10,000	$10,000	$10,000	$10,000		$18,920	$18,920	$18,920	$18,920	$18,920	$18,920	Corrected
B	Byers conservation WMS annual cost	4-20	Table 4-11		na	na	na	na	na	na		$0	$0	$0	$0	$0	$0	Deleted from DB12
B	Electra conservation WMS annual cost	4-20	Table 4-11		na	na	na	na	na	na		$10,712	$15,263	$15,263	$15,263	$15,263	$15,263	Deleted from DB12
B	Vernon conservation WMS annual cost	4-20	Table 4-11		na	na	na	na	na	na		$15,436	$21,550	$21,550	$21,550	$21,550	$21,550	Deleted from DB12
B	Capital Cost & Annual costs - Clay C-O Purchase Water from Local Provider	4-23	4th paragraph	$ 364,000	$ 326,000						$ 342,500	$ 322,500						Cost values were corrected in DB12.
B	Annual Costs for Montague C-O Develop additional GW	4-25	4th paragraph		$ 359,000							$ 329,070	$ 329,070	$ 137,580	$ 137,580	$ 137,580	$ 137,580	Cost values were corrected in DB12.
B	Annual cost for City of Lakeside- purchase water from local provider	4-30	last paragraph		$ 12,707							$ 12,708	$ 12,708	$ 12,708	$ 12,708	$ 12,708	$ 12,708	Cost values were corrected in DB12.
B	Lake Kemp Reallocation WMS volume	4-42	table 4-13			24,834	24,776	24,718	24,660	24,660			24,372	24,314	24,256	24,198	24,138	Corrected db12
B	Enclose Laterals in Pipe Annual Cost	4-43	last paragraph		$ 674,378							$ 677,768	$ 677,678	$ 6,778	$ 6,778	$ 6,778	$ 6,778	Cost values were corrected in DB12.
B	Total Capital Cost and annual cost for Montague Co Mining - Purchase Water From Local Provider	4-46	5th paragraph	$ 412,000	$ 241,000						$ 824,000	$ 482,074						Cost values were corrected in DB12.
B	Wichita Basin Chloride Control Project - Annual Costs	4-54	2nd paragraph		$ 7,572,425							$ 7,579,000	$ 75,579,000	$ 7,579,000	$ 7,579,000	$ 1,245,500	$ 1,245,500	Cost values were corrected in DB12.
B	Archer C-O Municipal Conservation WMS Supply	4-58	Table	18								10	15	19	23	24	25	Corrected.
B	Lakeside, Municipal Conservation WMS Supply	4-58	Table		na	na	na	na	na	na		3	9	10	11	11	11	Corrected IPP.
B	Archer County WMS Total volume	4-58	Table	1,900								321	1,676	1,723	1,768	1,808	1,928	added conservation to IPP table.
B	Byers Conservation WMS, Clay County	4-59	Table		na	na	na	na	na	na		1	3	3	3	3	3	Deleted from DB12
B	Clay C-O Municipal Conservation WMS Supply	4-59	Table	49								30	80	85	85	78	74	Correct in plan and DB12
B	Clay Co Total WMS Supply	4-59	Table	611								264	647	630	605	567	584	Correct IPP and DB12
B	Montague C-O Municipal Conservation WMS volume	4-60	Table		na	na	na	na	na	na		8	34	34	61	69	72	Deleted from DB12

REGION B

		IPP document reference:		Non-matching numbers: IPP document number							Online Planning Database (DB12) number							
Region IPP	Item	Page number	Table number	non-decadal number	2010	2020	2030	2040	2050	2060	non-decadal number	2010	2020	2030	2040	2050	2060	Response
B	Montague Co Mining Purchase WMS volume	4-60	Table	177								354	354	354	354	354	354	difference between selected and alternate
B	Montague Co WMS total volume	4-60	Table									964	1,050	1,052	1,250	1,259	1,262	Corrected in DB12
B	Montague C--O Purchase Water from Local Provider Alternative WMS Supply	4-60	Table		584							968	968	968	968	968	968	The alternative strategies do not necessarily require all components to be implemented. Options on sources.
B	Electra - Municipal Conservation volume in Wichita Co	4-60	Table		na	na	na	na	na	na		10	28	33	34	36	38	Deleted from DB12
B	Wichita Co WMS Total volume	4-60	Table	63,049								13,880	33,702	28,926	36,987	63,204	63,087	Corrected in DB12
B	Vernon Conservation WMS volume in Wilbarger Co	4-62	Table		na	na	na	na	na	na		45	122	144	148	148	146	Deleted from DB12
B	Total WMS supply for Wilbarger Co	4-62	Table							10,864		194	4,071	8,822	9,555	10,284	11,010	Corrected in DB12
B	Capital Cost & Annual costs - Clay C-O Purchase Water from Local Provider	Att 4-2, p 3		$ 364,000	$ 326,000						$342,500	$322,500						Cost values were corrected in DB12.
B	Wichita County Manufacturing Annual Cost	Att 4-2, p 12		$ 489,230							$ 489,258							Cost values were corrected in DB12.
B	Lockett Water System capital cost and annual cost	Att 4-2, p 16		$1,658,700 (Cap) $247,000 (AC)							$1,272,000 (Cap) $202,000 (AC)							Cost values were corrected in DB12.
B	Enclose Laterals in Pipe Annual Cost	Att 4-2, p 18			$ 674,378							$677,768	$677,678	$6,778	$6,778	$6,778	$6,778	Cost values were corrected in DB12.
B	Montague County Mining Capital and Annual Cost	Att 4-2, p 20-21		$654,000 (Cap) $79,025 (AC)							na							Cost values were corrected in DB12.
B	Total Capital Cost for Montague Co Mining - Purchase Water from Local Provider	Att 4-2, p 21		$ 412,000							$824,000							Cost values were corrected in DB12.
B	Annual Costs for Montague C-O Develop additional GW	Att 4-2, p 4			$ 359,000							$329,070	$329,070	$137,580	$137,580	$137,580	$137,580	Cost values were corrected in DB12.
B	Annual cost for City of Lakeside- purchase water from local provider	Att 4-2, p 9			$ 12,707							$12,708	$12,708	$12,708	$12,708	$12,708	$12,708	Cost values were corrected in DB12.
B	Annual costs for Wichita Co Manufacturing - Purchase water from local provider	Att 4-2, p 12			$ 489,230							$489,258	$489,258	$489,258	$489,258	$489,258	$489,258	Cost values were corrected in DB12.
B	Wichita Basin Chloride Control Project - Annual Costs	Att 4-2, p 22			$ 7,572,425							$7,579,000	$75,579,000	$7,579,000	$7,579,000,000	$1,245,500	$1,245,500	Cost values were corrected in DB12.
B	Conservation Relative to Total New Supplies, Additional Municipal Conservation volume	6-11	6-2		197	764	799	841	857	1,668		270	959	1,024	1,073	1,088	1897	Corrected in DB12
B	Conservation Relative to Total New Supplies, Increase Cons Elev of Lake Kemp WMS volume	6-11	6-2			24,834	24,776	24,718	24,660	24,600			28,198	28,142	28,076	28,010		DB12 is double counting WUG and WWP. No changes made.
B	Conservation Relative to Total New Supplies,, Groundwater Development - Montague County-Other	6-11	6-2		485	554	572	584	567	572		584	584	584	584	584	584	Change text in IPP